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RADIODERMATITIS

Its Prevention as a Sequel to Roentgen Therapy for Certain Common Dermatoses

GEO. H. CURTIS, M.D.

Every year we see a number of cases of radiodermatitis. It is depressing to inform an individual that the condition is permanent. Furthermore, we see the development and extension of carcinoma in radiodermatitis by growth and metastases, and the ingenuity of the dermatologist, surgeon, and roentgenologist is often taxed to destroy it. This results in more disfiguring scars and mutilations. Metastases are fatal. Not infrequently patients object to x-ray therapy even when they are convinced of its therapeutic efficacy because of the fear of sequelae.

Except, perhaps, in the treatment of cancer there is no legitimate excuse for radiodermatitis. In the treatment of non-cancerous dermatoses radiodermatitis is the result of mistakes in diagnosis, inadequate recording of previous x-ray therapy, allowing oneself to be persuaded by the patient or by the course of the eruption to excessive dosage, and failure to have the machines calibrated at regular intervals. Other reasons include failure to study the type of skin to be treated, and to recognize that x-ray therapy in many skin eruptions is not curative but palliative. Careful attention to these and other factors will reduce to an irreducible minimum the number of cases of sequela to roentgen irradiation.

Radiodermatitis as a sequela to modern irradiation technic may be said to be rare. A study of our records shows a ratio of less than two cases for 1000 admissions. The following table shows the distribution of radiodermatitis from roentgen therapy in 69 consecutive cases.

No. of Cases of Radiodermatitis	*Disease Treated*
8	Pruritus of vulva, anus, and scrotum
5	Acne vulgaris
5	Eczema of the hands
4	Keratoses (senile, seborrheic), moles
4	Verruca of palms and soles
3	Psoriasis
2	Epidermophytosis
2	Removal of hair
2	Atopic dermatitis
1	Lichen planus
1	Localized neurodermatitis
1	Lupus vulgaris
1	Tinea sycosis
*15	Radiodermatitis in doctors, dentists, and experimental workers
15	Miscellaneous (thyroid disease, carcinoma breast, sarcoma, hydrarthrosis, rheumatism, uterine tumors)

*Radiodermatitis in these cases was incurred in the course of professional work.

I shall not attempt to draw any far-reaching conclusions from the meager data derived from a study of the cases; however, certain facts stand out. Approximately one-fourth of the cases occurred in physicians, dentists, and experimental workers in radiology. Two physicians had been affected during the early days of roentgenology. One individual had been burned in the course of experimentation with roentgen rays and radium emanations. The remaining ten physicians had acquired the dermatosis through faulty fluoroscopic technic. Four of the dentists had been affected by holding dental films in patients' mouths during the exposure.

Of the 39 cases in which roentgen therapy had been administered for cutaneous disease, one case of acne vulgaris had been treated by an advertised skin clinic, and two cases of removal of hair by a nonmedical organization. The remainder of the cases had been treated by physicians who had given either a few large doses or too many small doses. The small doses had been given at short intervals over a long period of time up to one to two years. The untoward effects usually had not developed for one to three years after the course of treatment. This is the trap into which any physician may fall because the cumulative biologic effect of small doses is slow, and radiodermatitis is of late development. In the other cases in which a small number of treatments had been given, the dosages evidently had been large as the histories indicated irradiation reactions. Instead of permanently discontinuing treatment after a reaction, one or more additional treatments had been administered. The usual result had been a severe dermatitis which took weeks to subside.

It is of interest to note that the greatest number of cases of radiodermatitis occur in those dermatoses for which roentgen therapy is usually only palliative, or in which the amount of irradiation necessary to cure is dangerously close to that which causes radiodermatitis. In all the cases of pruritus of the vulva, anus and scrotum, eczema of the hands, verrucae, psoriasis, atopic dermatitis, and lichen planus not only was the disease not cured, but radiodermatitis also was added to it. The cases of keratoses, moles, removal of hair, lupus vulgaris, and tinea sycosis were cured, but radiodermatitis resulted. Carcinoma developed in the case of lupus vulgaris and in two cases of psoriasis. In some of the cases, both cured and uncured, painful non-healing ulcers added to the patient's discomfort.

CASE REPORTS

The following case reports are representative of those in the foregoing table. A discussion is included of the amount of roentgen therapy which may be given with impunity, its efficacy, and of other successful methods of treatment.

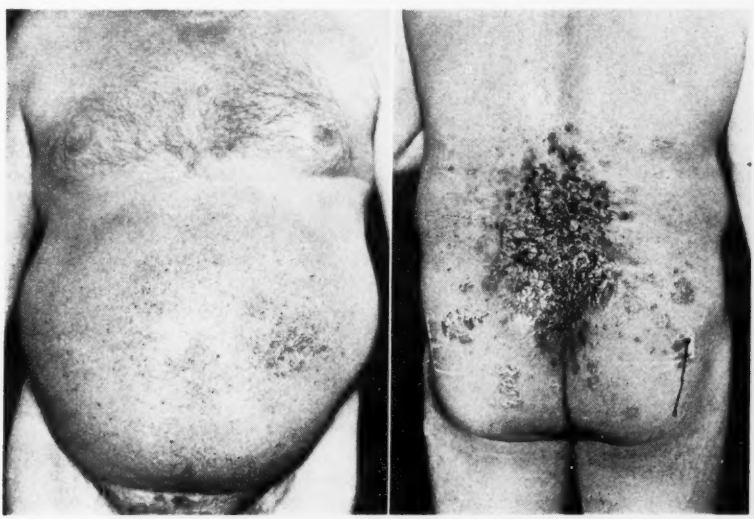
Case 1. Cirrhosis of Liver, Psoriasis, and Radiodermatitis with Ulceration.

An Italian, aged 52, came to the Clinic on August 15, 1941 complaining of an eruption on his body of five years' duration. Early in the course of the disease the eruption had disappeared following fever therapy, but had recurred about two years ago. Since then he had had generalized "light" treatments, and he estimated that he had had a treatment twice a week for a year. About two months ago a large area on his back had become ulcerated.

Six months ago he had noticed swelling of his abdomen. In the past few months he had had a pressure sensation in his chest and dyspnea on exertion. Other symptoms had been indigestion and anorexia. He had been a heavy drinker since the age of 16.

The physical examination showed ascites, caput medusa, enlarged heart, edema of the legs, and varicose veins. Typical plaques, nummular and guttate lesions of psoriasis were disseminated over the cutaneous surface, with the exception of the scalp, face, hands, and feet. The anterior surface of the trunk, thighs, and legs showed large areas of telangiectasia, atrophy, scaling, and deep fibrosis of the dermis. The entire lumbar and sacral regions, the buttocks and posterior surfaces of the thighs showed similar changes. In the midpart of the lumbosacral region was a large area of ulceration with fungating tumor masses of granulation tissue varying from pea to walnut size.

A macrocytosis and 20 per cent bromsulfalein test confirmed the diagnosis of cirrhosis of the liver. The dermatosis was typical of psoriasis, and the telangiectasia, atrophy, fibrosis, and ulceration were typical of radiodermatitis. Unfortunately, the patient's physical condition prohibited excision and subsequent skin grafting of the ulcerated area.



LEGENDS

FIGURE 1. A. Chronic radiodermatitis with telangiectasis, atrophy, keratosis, and fibrosis. Case 1.

B. Radiodermatitis with deep ulcerative vegetation. Note psoriatic plaques at the periphery.

COMMENT

Roentgen therapy, in spite of the danger of radiodermatitis, is one of the best therapeutic methods in the treatment of psoriasis. It is clean, simple of administration, and frequently causes complete disappearance of lesions. Not uncommonly, however, in resistant cases the lesions are refractory to x-rays, and in spite of continued irradiation the old lesions persist and new lesions appear. The usual and safe scheme of treatment consists of 75 r of low voltage and unfiltered irradiation at weekly intervals for six to ten treatments. In generalized irradiation overlapping of the fields of exposure should be avoided. If the eruption does not respond to this amount of treatment, it may be classified as resistant, and further irradiation usually is valueless. With good judgment and a careful recording of the cutaneous areas treated, recurrent eruptions may be treated as long as the lesions respond to short courses of a few treatments if the recurrences are several months apart or in areas not previously treated. In my opinion sixteen to twenty treatments should be the maximum in such cases. Ordinarily when this amount of treatment is reached, it will be found that the recurrences have failed to respond favorably.

Keratolytics such as salicylic acid, chrysarobin, anthrolin, neorobin, tar, and pyragallol should not be used for at least one or two weeks before and after roentgen therapy.

Case 2. Chronic Recurrent Eczematoid Dermatitis of the Hands. Acute Radiodermatitis and Contact Dermatitis.

A white woman, aged 25, came to the Clinic on October 9, 1939, presenting swollen hands and a painful dermatitis extending almost to the elbows. Since childhood she had had a recurrent, vesicular and itching dermatitis on the hands. Following an x-ray treatment in July, 1939 her hands had become swollen, red and painful. Another treatment in September, 1939 had been followed by marked redness, swelling, and pain. An ointment had been prescribed, and a few days later an acute, itching dermatitis had appeared, extending to the elbows.

On examination the hands were found to be swollen and red with small ulcerations, and an acute vesicular pruritic dermatitis extended over the forearms to the elbows. A secondary pyodermia was also present.

After several weeks of treatment with potassium permanganate soaks, soothing lotions and ointments the acute symptoms subsided. Patch tests with the incriminated ointment and its chief ingredients, benzocaine and picric acid, were positive.

Three months later early signs of chronic radiodermatitis with dryness, scaling, pigmentation, and slight telangiectasia were apparent. A year later atrophy, keratoses, and telangiectasia on the dorsa of the hands and the palms were plainly evident, in addition to nummular patches of vesicular eczematoid dermatitis.

COMMENT

Information was obtained that a total of 5,270 r with copper and aluminum filtration had been administered in 1935, 1936, 1937, 1938 and 1939. By rough calculation, the total irradiation had been approxi-

mately 9700 r for back scattering and exposure of palms and dorsa of hands separately. Obviously, this amount of irradiation had been sufficient to cause radiodermatitis. The acute symptoms had not appeared until after the last two treatments of 210 r each two months apart, thus demonstrating the cumulative effect of roentgen rays. These two treatments with ½ copper filter had not been sufficient in themselves to cause symptoms.

The superimposed contact dermatitis and secondary pyodermia complicated the acute symptoms of the radiodermatitis. The former dermatoses subsided in about ten days, and the underlying edema, ulceration, and erythema of the latter were revealed, which did not begin to subside until several weeks later.

COMMENT

In many cases of eczematous dermatitis on the hands and/or feet the eruption may be classified as a contact dermatitis, an eczematoid dermatitis from primary irritants and physical agents, a nummular eczema, an atopic dermatitis, a dermatomycid, or a cheiropompholyx, and appropriate therapy may include a minimum amount of roentgen irradiation[1]. Nummular eczema and cheiropompholyx are among the eczematoid eruptions of unknown cause, and recurrences are common. Roentgen therapy in these conditions is dangerous, as it is merely palliative and the limit of safety is rapidly exceeded. If after a thorough investigation the cause of the dermatitis is not found and roentgen therapy is necessary for relief, three to eight treatments of 75 r each of low voltage, unfiltered irradiation at weekly intervals may be administered. If this amount does not produce a favorable result, irradiation is discontinued. It is my practice to stop treatment of recurrences for several years at least when a total of 1200 r has been administered.

Case 3. Radiodermatitis and Carcinoma Following Treatment of Lupus Vulgaris.

A Scotsman, aged 38, came to the Clinic on January 25, 1938 presenting a growth on the right cheek. During infancy and up to the age of 15 he had been treated with x-rays for lupus vulgaris. In later years radiodermatitis had developed on the face and neck. Four years ago a small nodule had appeared in the area of healed lupus scars and radiodermatitis near the right commissure of the mouth. By simultaneous extension and cicatrization the lesion had migrated toward the ear.

The general physical and laboratory examinations including roentgenograms of the chest were normal.

Both sides of the face and neck showed extensive scarring and radiodermatitis. A number of keratoses were disseminated over the affected areas. On the right side of the face, extending from the commissure of the mouth to the ear, was a band-like scar, and at its upper pole was an elevated tumor mass which was the size of a half dollar and was crusted and bled easily. Along the scar were smaller, crusted, less-elevated nodular lesions. There was no regional adenopathy. Histologic examination of a small piece of the tissue showed squamous cell carcinoma.

From January, 1938 to July, 1939 the lesion was given a total of 1150 millicurie hours of radium. In October, 1940 a recurrence was noted. In September, 1941 the

ulcerated recurrence was excised, and a Thiersch graft applied. The patient is still under observation, and there is no evidence of recurrence of the carcinoma.

COMMENT

Lupus vulgaris was one of the first skin diseases to be treated with x-rays. Early reports gave a high percentage of cures because early workers did not hesitate to produce severe reactions. Later, when serious sequelae of radiodermatitis made their appearance, x-ray therapy became more conservative, and the percentage of cures decreased. In the United States x-ray therapy has been largely superseded by other methods, including excision of small plaques, electrocoagulation, cold quartz ultraviolet irradiation (Kromayer lamp), and salt-free diets. Kile[2] has recently described a method of injecting a starch solution into the lesions. This method has shown some promising results and deserves further trial.

When the decision to use roentgen therapy is reached MacKee[3] advises routine administration of 225 r unfiltered every four weeks for three or four treatments. In children 150 r is the usual dose. The remaining nodules may be destroyed by other methods.

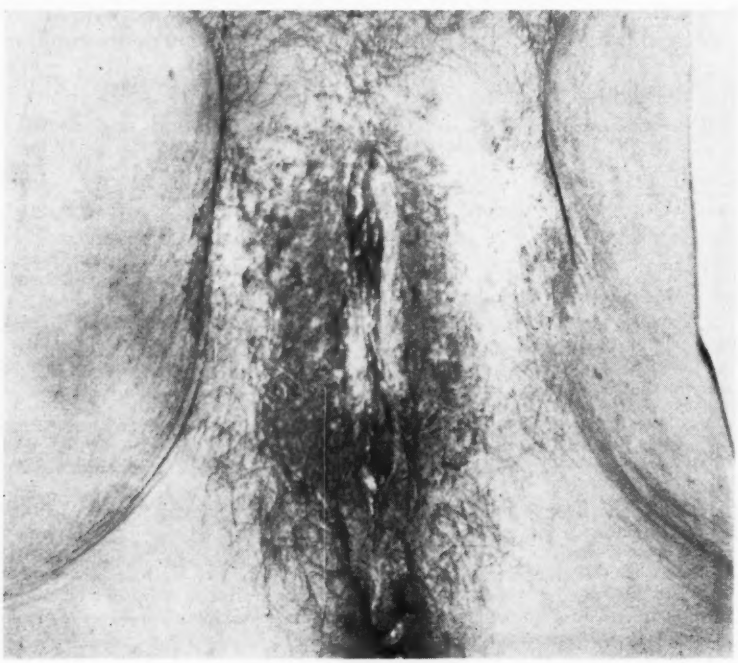


FIGURE 2. Radiodermatitis following roentgen therapy for pruritus vulvae. Case 4.

Case 4. Pruritus Vulvae and Radiodermatitis.

A secretary, aged 36, came to the Clinic on September 21, 1936, complaining of pruritus of the vulva which she had had for six years. There had been periods of remission for a few months at a time. She had had 31 x-ray treatments, each being one-third skin unit, given at intervals of two to four weeks for two years. The last treatment had been in 1934. She had first noticed a developing telangiectasia on the vulva in 1935.

Examination showed telangiectasia, atrophy, and keratoses of the vulva and the medial surfaces of the thighs. In addition the vaginal mucosa was inflamed, and a frothy discharge was present. A specimen of the discharge contained numerous trichomonas vaginalis organisms.

The trichomonas infection was cured, and the pruritus was treated by an hydrochloric acid injection. This relieved the pruritus, and the patient was lost from observation.

COMMENT

A thorough investigation should be made to find the various organic and neurotic causes of pruritus of the vulva and anus. Topical soothing and antipruritic measures including a minimum of roentgen irradiation may be used during the course of study. If 75 r of low voltage unfiltered irradiation once weekly for six to ten treatments is not sufficient to stop the pruritus, x-ray therapy should be stopped. Recurrences are most troublesome and lead to excessive irritation and radiodermatitis. If combined etiologic and dermatologic management including roentgen therapy fails to cure the pruritus, it is then necessary to resort to alcohol injections, which may be repeated one or more times. I have had no experience with the tattoo method[4] for pruritus ani, although the literature indicates promising results.

Case 5. Epidermophytosis of the Feet and Radiodermatitis with Ulceration.

A white woman, aged 33, came to the Clinic on crutches on August 14, 1941, complaining of severe pain and ulceration of her right foot. In May, 1940 a vesicular eruption had appeared on the sole, had been diagnosed as ringworm, and five x-ray treatments had been administered as follows: three treatments in May, one in July, and one in August. Several days after the last treatment the foot had begun to turn red and to swell. Later blisters and ulcerations had appeared. The acute symptoms had begun to subside after about five weeks. From time to time during the following year painful ulcerations would occur and heal. The patient had been using crutches since the acute dermatitis had subsided.

On examination the right ankle and foot were found to be swollen. The margins of the foot showed telangiectasia which extended to an area of keratosis, ulceration, scarring, and fibrosis involving the arch and heel. The keratoses were islands of piled-up wart-like epithelium. The ball of the foot and toes were free of dermatitis.

The patient was admitted to the hospital, the affected area excised, and a skin graft applied. The graft was successful, but she has not yet been permitted to walk without crutches.

COMMENT

If this case had been diagnosed as one of epidermophytosis and the diagnosis confirmed by microscopic examination of vesicle roots and scales for fungi, the fungous infection could in all probability have been cured without roentgen irradiation. Dermatologists resort to roentgen

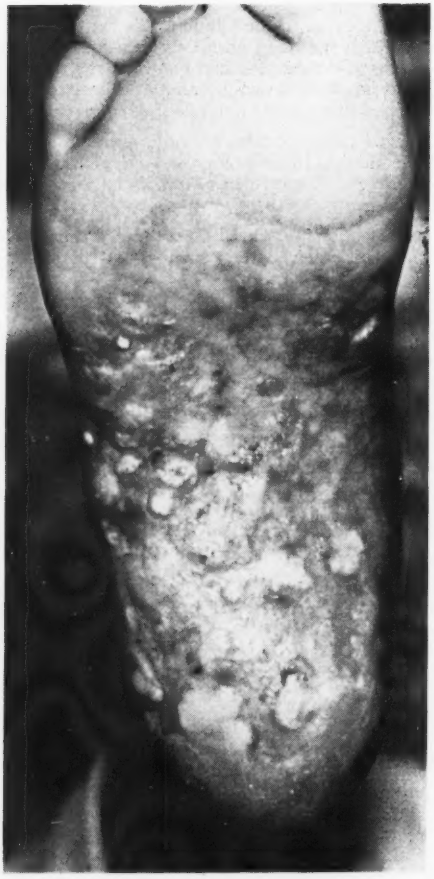


FIGURE 3. Radiodermatitis of sole following roentgen therapy for epidermophytosis. Case 5.

therapy when the dermatophytosis is obstinate or hyperkeratotic. Roentgen rays do not kill fungi, but are used for their stimulating and healing effect on tissues. Consequently, seldom more than 6-10 treatments of 75 r each at weekly intervals is necessary.

The amount of irradiation could not be determined from the history, but it must have been in large doses since four treatments of 75 r or even 100 r each would not have produced an acute radiodermatitis. The epidermophytosis was cured.

Case 6. Verruca Plantaris and Radiodermatitis with Ulceration.

A married woman, aged 30, came to the Clinic on May 23, 1941, complaining of an ulcer on the ball of the right foot of nine weeks' duration. A diagnosis of verruca plantaris had been made, and the lesion had been treated with five x-ray treatments one week apart. The sixth treatment, as the patient's physician had told her, had been equal to the total amount of the previous five doses. It had been given in the sixth week. Two weeks later a seventh treatment with the same dose as the sixth treatment had been given. After about three weeks the treated area had become red, swollen, and painful. A scab had formed and upon removing it, a large deep hole filled with fluid had been exposed. During the succeeding nine weeks the ulcer had failed to heal.

On examination an ulcer 1 cm. in diameter was seen directly overlying the first metatarsophalangeal joint and was located in the center of a red, swollen, edematous area which included several toes and extended to the middle of the arch of the foot. The entire area was painful, and the lesion had a foul odor. A wart was present at the base of the great toe distal to the rim of the ulcer.

The patient was instructed as to local treatment with potassium permanganate soaks and soothing ointments. Four months later, after the swelling and inflammation subsided, the ulcer and surrounding tissue showing early chronic radiodermatitis was excised, and the area skin-grafted.

COMMENT

Warts are capricious. There is no clinical sign which will indicate whether or not a wart will be amenable to x-ray therapy, but in many instances the minimal therapeutic dose administered by dermatologists is sufficient to cure. The technic is important. The wart should be carefully trimmed, and the normal skin should be well screened with lead and red rubber. Lead shields, 2 mm. thick, 3 by 5 inches in size, in the center of which round holes are punched varying from 3 to 15 mm. in diameter are used to isolate the wart from the normal skin.

The routine dosage as given by MacKee is used. The dose varies from 300 to 1200 r depending on the size of the wart. Larger doses of 600 to 1200 r are given to small warts with thick hyperkeratoses or to larger warts which are deep with thick hyperkeratoses. If a 300 r dose is given and if at the end of four weeks there is no response to treatment, another treatment is given. If larger doses (600 to 1200 r) are given, the interval between treatments is up to three months. If a second treatment does not effect a cure, other methods must be tried.

Contact x-ray therapy seems to be rapidly coming into the fore in the treatment of verrucae. With this low voltage (40 to 50 KV), a large amount of beta rays (2000 to 4000 r) is concentrated within the substance of the wart itself and is without sequelae, except that the early reaction may be slightly more severe with large doses than that which follows x-ray therapy. This reaction subsides without subsequent radiodermatitis. This method is especially useful when there are numerous plantar or palmar warts. A dozen warts may be treated in much less time than it takes to treat one wart by x-ray and because of the size and shape of the instrument, no lead shields need be used, nor is the

tedious procedure of punching holes in lead foil to fit over the warts necessary. Contact x-ray is also valuable in the treatment of small carcinomas, senile keratoses, hemangiomas, small keloids, and precancerous dermatoses.

DISCUSSION

Radiologists and dermatologists disagree somewhat about the practical application of roentgen therapy. The radiologist tends to use higher voltages, greater filtration, larger doses, and shorter intervals between

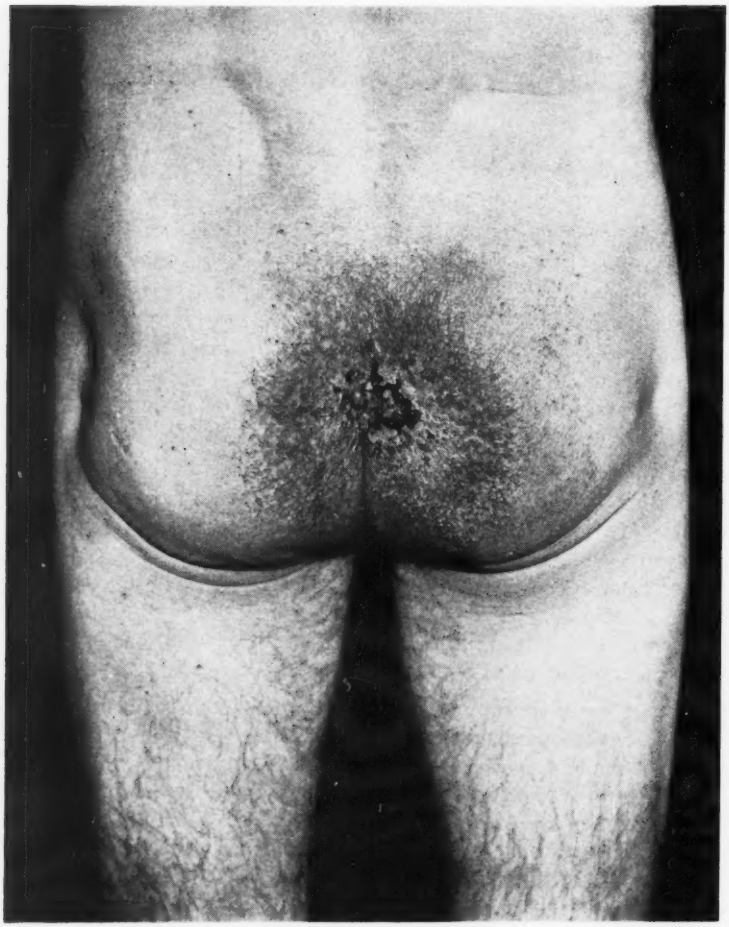


FIGURE 4. Radiodermatitis with ulceration following roentgen therapy for pruritus ani.

treatments; whereas, dermatologists employ lower voltages, little or no filtration, smaller doses, and longer intervals between treatments. Important requirements in the use of either method are (1) that the physician use a calibrated machine; (2) that he have wide experience in the diagnosis and treatment of skin diseases, and (3) that he know the limits of safety of the particular method used to avoid radiodermatitis, since the object of roentgen therapy is to ameliorate or cure cutaneous affections without leaving irradiation sequelae.

The modern, well-trained dermatologist uses great discrimination in the treatment of various dermatoses with roentgen therapy, as it is only one of the many therapeutic methods in his armamentarium. Irradiation is employed when, after careful consideration, it is the treatment of choice at a particular time in the course of the dermatosis. For example, in generalized psoriasis much of the eruption may be made to disappear by topical treatment; however, when a few of the more resistant lesions remain, they may be cleared up by a few roentgen ray treatments (of 75 r each). In recurrences this method may be used a number of times, and at the same time the amount of irradiation is held within safe limits.

Forcing the issue with irradiation therapy by increasing the number and/or size of the doses or by shortening the interval between treatments is likely to have serious results. Repeated recurrences or increasing resistance of an eruption to irradiation are common causes. If a small number of treatments fail to cause a psoriatic or a plaque of circumscribed neurodermatitis to disappear, irradiation should be discontinued for several months. A repeat course may then cause it to clear up.

The variation in susceptibility of various parts of the cutaneous surface is important in determining the amount of irradiation to be used. The face is the most sensitive part. Therefore, during the course of treatment of acne vulgaris, rosacea and the like, the skin should be carefully scrutinized for evidences of irritability, such as increased reactivity to heat, light, friction, emotional excitement, and also dryness and fine wrinkling, etc. The tendency of keratolytics to increase irritability adds to the x-ray effect. The flexures are very sensitive, and the thin skin over the external surfaces of the joints are more sensitive than that in the immediate vicinity. The scalp, palms, and soles are the least sensitive parts. The mucous membranes are more sensitive than any region of the cutaneous surface.

Hyperemia and congestion, as well as inflammation produced by topical medication (counterirritants, ultraviolet irradiation, etc.), may heighten the biologic effect of x-rays more than is anticipated. Thus, roentgen therapy to sensitive areas with these superimposed factors may result in an unexpected radiodermatitis.

The location, extent, depth, and nature of the pathologic process are the deciding factors in the quality and quantity of irradiation to be administered. In the foregoing list of dermatoses the process is superficial. The range of depth varies from the epidermis and papillae (eczematous and eczematoid dermatoses) to the level of the sweat glands (lupus vulgaris). Consequently, in these dermatoses (and other superficially located dermatoses as well) the object is to deliver to the affected depths as many r as possible without affecting the more deeply situated important structures. From the dermatologist's viewpoint low voltage (80 to 100 KV) unfiltered roentgen therapy serves this purpose. According to Cipollaro[5], at the level of the sebaceous glands (about 1 mm.) 22 per cent of unfiltered irradiation at 40 KV peak and 16 per cent at 100 KV peak is absorbed, while only 8 per cent at 140 KV with 3 mm. Al filter is absorbed. Thus, of a 75 r dose at 80 KV unfiltered irradiation, 13.5 r is absorbed in the first millimeter of skin, while of 75 r at 140 KV with 3 mm. Al filter, only 4.5 r is absorbed. At 3 mm. depth (level of hair bulb) 30 r of a 75 r dose at 80 KV unfiltered irradiation is absorbed, while only 10.5 r of the same dose at 140 KV 3 mm. Al is absorbed. Consequently, larger doses of high voltage filtered irradiation at shorter intervals are necessary for the absorption of the same quantity as that of low voltage irradiation at the same level to obtain the same biologic effect. Furthermore, larger doses of filtered high voltage irradiation at shorter intervals unnecessarily affect the deeper structures. On the other hand, the erythema dose of low voltage unfiltered roentgen rays is 300 to 350 r; whereas, it is up to 700 r for high voltage heavily filtered irradiation. This influences the dermatologist to be exact in his judgment, technic, and the diagnosis; but since a larger number of r is absorbed from a smaller dose of low voltage unfiltered irradiation in the upper layers of the skin where the pathologic process is located, he is able to give smaller doses at longer intervals and to follow the biologic effect on the *skin* during the course of treatment.

SUMMARY

This article is limited to a brief discussion of the principal factors in the etiology of radiodermatitis from roentgen therapy in 69 cases. Of the 69 cases 39 were the result of treatment of superficial dermatoses; 15 cases occurred among physicians, dentists, and experimentalists; and 15 cases were the result of treatment of cancer, sarcoma, thyroid disease, etc. The cases of radiodermatitis in the treatment of cancer, sarcoma, etc. have not been discussed.

Five case reports of representative superficial dermatoses with superimposed radiodermatitis selected from the list of 39 cases are given in addition to a brief description of an accepted method of administering a safe total dose of superficial low voltage unfiltered roentgen therapy.

Radiodermatitis may be prevented in the treatment of superficial skin diseases either by the method of high voltage, filtered irradiation or by low voltage, unfiltered and superficial irradiation if three principles are fulfilled: (1) calibration of machines, (2) a wide experience in the diagnosis and treatment of skin diseases, and (3) a knowledge of the limits of safety of the method used. Other minor factors discussed are (1) the failure to record previous roentgen therapy; (2) the failure to study the color and type of skin treatment and variations in sensitivity of different regions of the cutaneous surface; (3) the necessity for a thorough knowledge of the characteristics and course of the particular dermatosis under treatment; (4) avoiding the use of keratolytics during roentgen therapy; and (5) avoiding the trap of "forcing the issue" in the treatment by the physician allowing himself to be persuaded to give excessive treatment either by the course of the eruption or by the patient.

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TRANSPOSITION OF THE ANUS

Report of a Case

WM. E. LOWER, M.D.

The case which is herewith reported was that of a girl, aged 4½, who was first seen in September, 1939 with a chief complaint of congenital absence of the rectal opening in the perineum; however, she had an opening into the vagina (Fig. 1) which in appearance was not unlike a normal anus. The only repair had been a slight enlargement of the opening into the vagina to permit freer bowel movements.

The patient had an almost constant fecal drainage unless she was constipated; then she had formed stools. There was no history of bladder difficulty nor nocturia, although there had been some frequency;

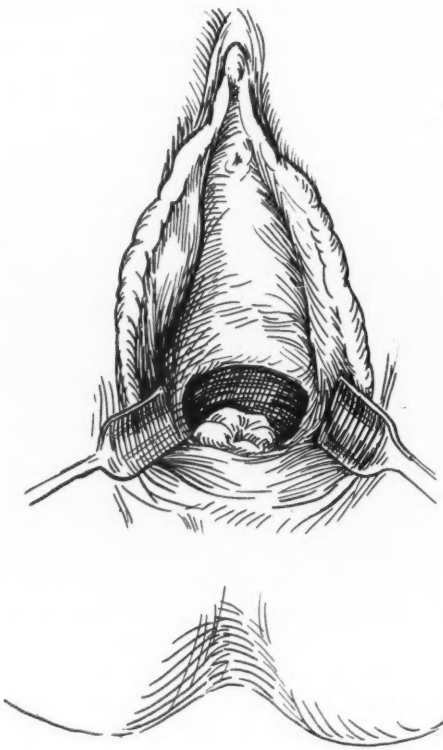

FIGURE 1. Diagram showing the opening in the vagina.

and the child had good bladder control. Some voluntary control of bowel movements also had been observed.

In June, 1941 the patient was admitted to the Cleveland Clinic Hospital for operation. Under general anesthesia a loop sigmoid

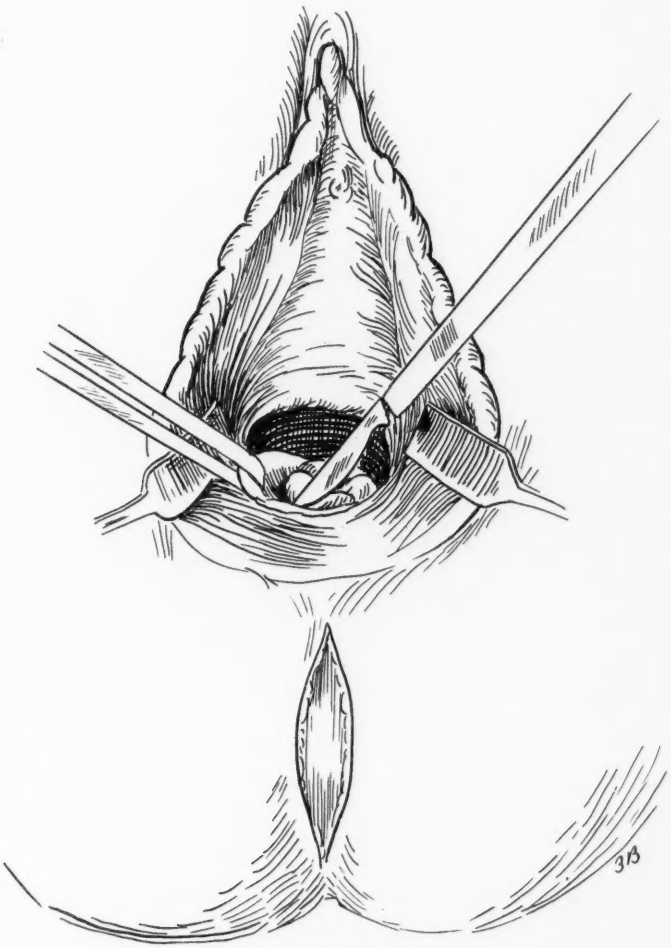

FIGURE 2. Separation of the opening in the vagina and the perineal incision.

colostomy was performed, after which the lower bowel was thoroughly cleansed. When the colostomy was functioning well, an opening was made in the perineum, and the opening in the vagina dissected free

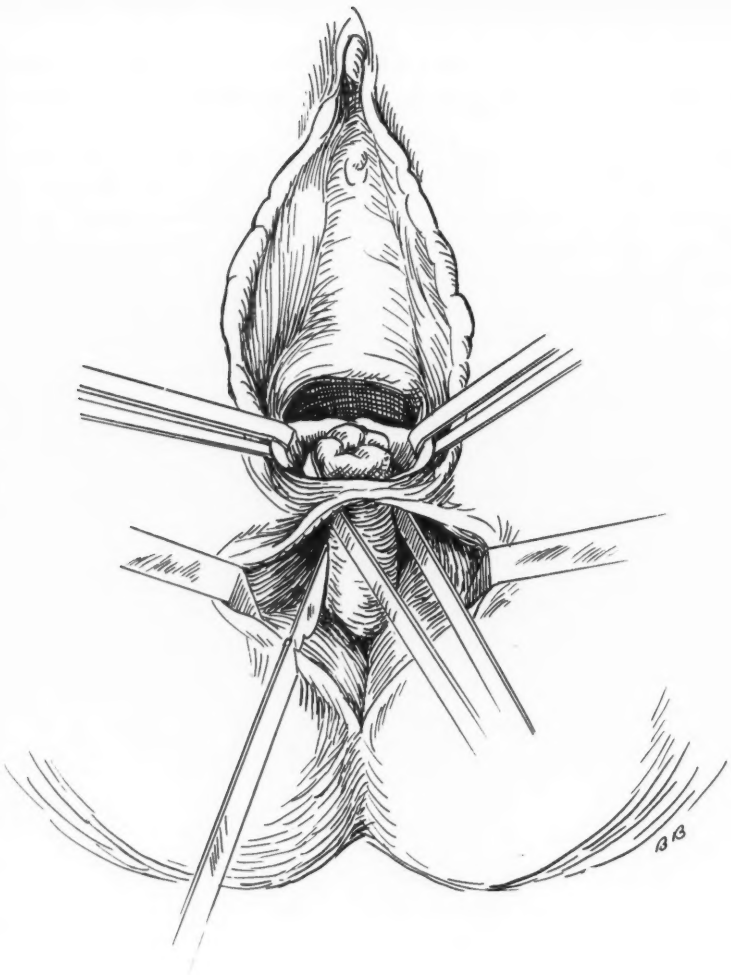

FIGURE 3. Freeing the opening into the vagina.

(Figs. 2 and 3). With a long forceps this part of the gut was transposed to the new opening in the perineum (Fig. 4). The transposed opening was then sutured to the skin and perineal tissue. A perineorrhaphy was performed which obliterated the newly made opening in the vagina (Fig. 5). The child's mother was instructed in the dilatation of the anus

every other day, and the child was sent home to return later for closure of the colostomy.

In September, 1941 the patient was readmitted to the hospital, and Dr. T. E. Jones closed the colostomy. Examination of the rectum re-

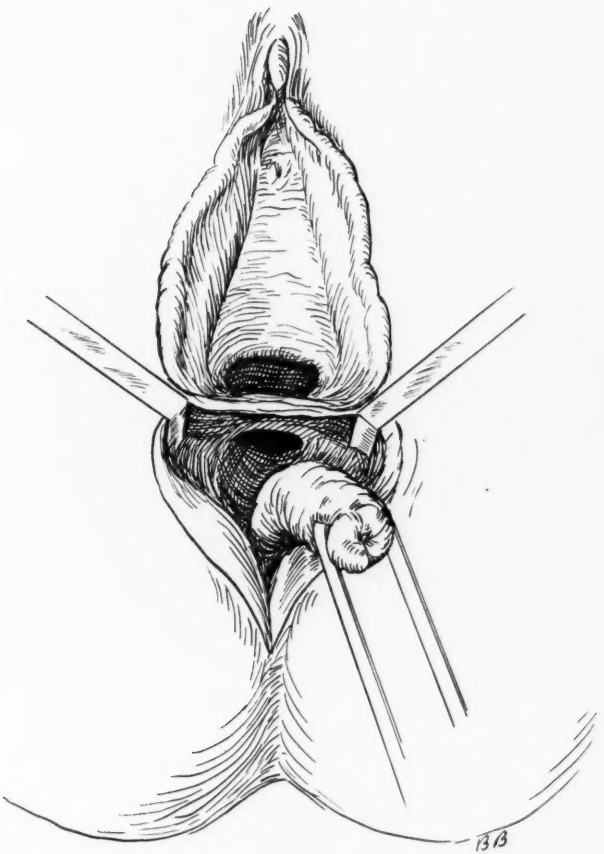

FIGURE 4. Replacing the gut into the perineum.

vealed a tight fibrous anus, and the smallest Young dilator was inserted into the rectum and left in place. After a two weeks period of hospitalization, the patient was discharged to return for closure of the colostomy when the function of the anus was adequate.

The patient was readmitted in October, 1941, and the colostomy closed. Upon discharge from the hospital, the patient was having normal evacuation and peristalsis, and her condition was good.

SUMMARY

The case herewith reported probably would be classified with the cases of congenital rectovaginal fistula, but in this instance the opening was at the end of the rectum and seemed to give the appearance of a transposed anus rather than that of a fistula from the rectum. The

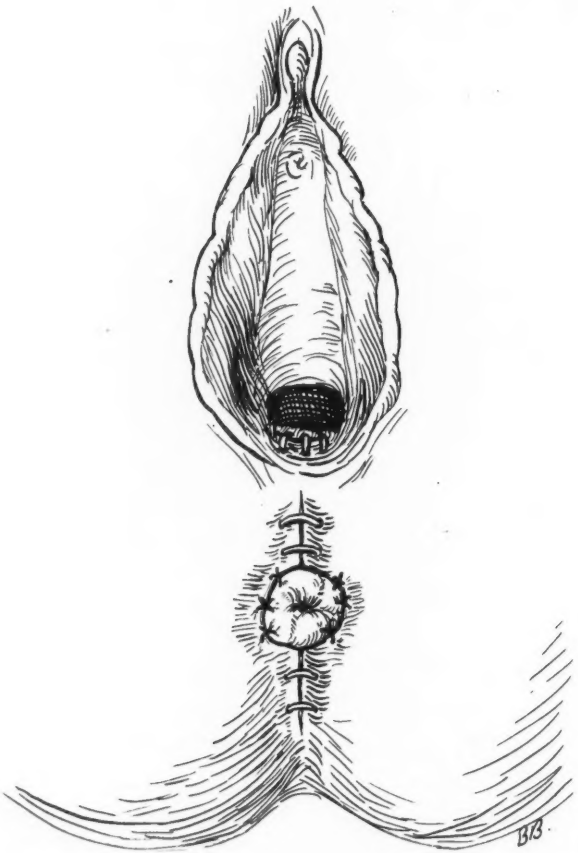

Figure 5. The completed operation.

opening in the vagina was just inside the margin of the vagina. The sphincter was not very efficient, and anal incontinence was one of the symptoms. The treatment consisted in making an opening in the perineum and transposing the opening which was in the vagina to the location in the perineum corresponding to that of a normal anus. In this way the gut was not cut, but the opening dissected free from the vagina and transferred to the perineum, thus obviating the necessity for closing the original opening and establishing a second opening which would be more liable to contraction and stricture.

DIAGNOSIS AND TREATMENT OF BRUCELLOSIS

(*Undulant Fever*)

CHARLES L. HARTSOCK, M.D.

Not only the treatment but also the diagnosis of undulant fever are far from being satisfactory, although many types of therapy are being tried and critically evaluated. Because of the tremendous scope of the disease, frequent discussions and reappraisals of our ideas about brucellosis will be absolutely essential for some time. Some physicians more or less disregard brucellosis and even scoff at the chronic phase of this new intruder in the realm of human disease. Others are overenthusiastic and attempt to explain many vague and indefinite problems upon the basis of chronic brucellosis without sufficient evidence. Still other physicians have lost their original enthusiasm and have reverted to the first viewpoint, probably because of the great difficulty in coping with the caprices and vagaries of this disease and the marked uncertainties in diagnosis and treatment.

Even though this disease is extremely protean and remarkably bizarre in its manifestations, it is a disease of known causative organism to which the generic term of brucella has been given.

The original infection in man was traced to the drinking of goat's milk on the Island of Malta, and for many years this disease was known as Malta fever. Because of the undulating character of the fever with a tendency for remissions and recurrences, it was later called undulant fever which proved to be a very poor description of the febrile reaction in many instances. Brucellosis is the more specific term derived from the organism causing the disease.

Three strains of the brucella organism have been isolated and named for their respective hosts: b. melitensis for the goat strain; b. bovine for the cattle strain; and b. suis for the swine strain. Many other animals are infected with these strains, and man is subject to all three. The virulence of the organisms differs, the bovine strain being the least malignant. However, cattle are frequently infected with the swine type, and as man usually contracts the disease from cattle, he is afflicted with the more virulent b. suis in spite of the infective source. The infection localizes in the udders of cattle and contaminates the milk which is the chief source of infection to man. The known modes of infection are the following:

(1) *The ingestion of milk and milk products.* Complete pasteurization prevents infection with the brucella organism. The danger lies either in unsuspectingly drinking unpasteurized milk, or in disregarding this potential source of infection because of the effect of pasteurization upon

the quality and taste of milk. This mode of infection is common in rural districts, as on most farms the milk is always used without pasteurization. A patient of mine who owns a dairy in a community which is very adverse to pasteurization told me that he pasteurizes his milk without labeling it as such and has never had one complaint about the taste of the milk since he started to pasteurize it. A very great danger lies in incomplete pasteurization, which is a source of infection extremely difficult to control. Milk products, especially ice cream from unpasteurized milk, are also a potential source of infection. I learned from a patient whose daughter and herself had contracted brucellosis from drinking unpasteurized milk that all the ice cream used at the church socials in her community is made by a neighbor who utterly disregards the fact that his herd is infected. As long as this attitude prevails, the control of this disease will be difficult. Fortunately cheese products are usually made from pasteurized milk. Goat's milk is supposedly beneficial in the treatment of gastrointestinal diseases and is another potential source of infection when used in this way as it is very seldom pasteurized.

(2) *The handling of infected material.* Farmers and veterinarians are especially subject to this mode of infection. The handling of the aborted fetus and membranes is so virulent a source of infection that nearly all veterinarians have contracted this disease. Many of them, however, show very strong immune reactions seemingly without having passed through an active phase, which would suggest that immunity can be built up by contact with the disease without having it in an active phase. Direct contact with infected cattle in milking and in handling the infected milk is another possible source of infection. I also believe that it is possible to contract this disease by handling infected meat, although this is not so likely a source of brucellosis as it is of tularemia. I have one patient, a meat handler, in whom no other contact with the disease could be demonstrated.

(3) *The ingestion of infected material, especially meats, that are likely to be uncooked.* This is probably a rare source of infection and a rather difficult one to trace.

(4) *Contact with humans who have the disease.* Infection from direct contact is unlikely, and with ordinary sanitation in the disposal of excreta one need not fear infection from this source. Laboratory workers, however, are very likely to be exposed in working with human cases and should exercise every precaution.

(5) In many cases it is impossible to trace the source of infection, and probably some other rare and unusual mode will eventually come to light.

The clinical types of brucellosis are extremely variable. However, they fall into three general groups.

(1) The acute febrile type is a clean-cut infectious process usually beginning as an ordinary influenzial type of infection with fever, chills, aches and pains, and pronounced weakness. The most characteristic and best lead-directing clue to the nature of the underlying infection is the presence of very severe sweats especially during the night. Symptoms may be prominently localized in several domains. In the respiratory system a severe and prolonged type of bronchitis leads one to suspect whooping cough. The disease frequently localizes in the central nervous system producing symptoms of meningitis and encephalitis and in this form has the highest mortality rate. It may also produce an acute type of arthritis simulating acute rheumatic fever, although joint pains and aches are much more common in the chronic type of the infection. Various gastrointestinal manifestations are also seen in acute brucellosis.

Although acute brucellosis usually begins as an influenzal type of infection, some other type of infection is suspected after the fever has been sustained for a week or longer. The fever chart may strongly simulate the sustained highly elevated, so-called typhoid type of temperature curve which may last six to seven weeks. It usually subsides gradually and sometimes permanently without any further episodes of this disease; however, it may go into a relapsing type and after two or three relapses eventually subside; or it may go into the undulating type and continue for an indefinite period of time. Aside from the prominent sweating and history of possible exposure to the brucella organism, very little distinguishes this type of acute illness from many other acute infectious diseases.

(2) The intermittent or undulant form either may be residual of acute brucellosis, or occur without passing through the acute phase. Undulating brucellosis assumes all the manifestations and complications of the acute type, but the attacks are usually less severe, do not last so long, and the fever is seldom so high. The attacks may recur once or twice a year, or again they may occur quite frequently. One of the best clues to the diagnosis of this type of infection is that the patient thinks that he is getting the "flu" too often. A history of four or five attacks of influenza, or what the patient thinks is influenza, with fever, aches and pains, and symptoms in various domains should suggest the possibility of the undulant form of brucellosis. The patient may feel reasonably well between these attacks, but as a rule lacks the endurance of the average individual and fatigues more easily.

(3) The chronic or continuous type of brucellosis is a more persistent form which may be either febrile or afebrile. In the febrile type a low grade continuous daily fever rarely exceeds 100 degrees F. but occasionally has a single reading which may reach 102 to 103. Other symptoms are weakness, fatigability, aches and pains, particularly in

the joints, ribs, and spine. The patient may be very nervous and restless, irritable, and in general present the picture of chronic nervous exhaustion or neurasthenia, except for the low grade fever.

The afebrile type presents the same clinical picture except that the temperature is absent. There is a question as to whether the afebrile type, or even the very low grade febrile type, is really a manifestation of active undulant fever, or whether the whole picture is a chronic neurasthenic and fatigue state resulting from exhaustion of the nervous system and inability to maintain thermostatic control of the body. Undoubtedly, many patients present this clinical picture in whom chronic brucellosis or any other infection cannot be demonstrated. The diagnosis of such cases is not easy because of the limitations of diagnostic methods for determining the activity in patients who have reactions indicative of exposure to brucellosis. A very important distinguishing point is the background of the patient. If a patient with a background of good health and good inheritance has had a sudden change in health, and if some of the symptoms and results of diagnostic methods suggest undulant fever, a therapeutic trial is indicated. Whereas, if the patient has a poor constitutional background which might be the basis for his symptoms, the evidence should be weighed more carefully because the severity of the treatment we have to offer at the present time is likely to do more harm than good. Good clinical judgment tells us that even though some of these cases may have brucellosis, it is better to treat them purely as a chronic exhaustion state.

Methods of Diagnosis. In any unexplained disease state manifesting any characteristic of acute infection, or in an undiagnosed chronic disease state, diagnostic methods should be used to detect the presence of chronic brucellosis. The history of exposure should be elicited giving special attention to veterinarians, meat handlers, farmers, users of unpasteurized milk, and laboratory workers. I believe it advisable to check this group of workers routinely in any chronic disease state.

The pathology and objective clinical findings detected by routine physical examination tend to turn the attention away from the real underlying disease as they often serve as false clues and are apt to lead to the diagnosis of a symptomatic disease syndrome.

The only diagnostic methods of any specific value are laboratory studies of which blood culture is the most specific with the isolation of the organism in the acute cases. The organism is rarely found in chronic cases, although a culture of a local focus may make a specific diagnosis. The growth of brucella organisms has been reported from periovarian abscesses, and in one of our cases a culture was obtained from the gallbladder. Similar methods at the autopsy table have frequently made the diagnosis of otherwise undiagnosed cases.

Agglutination tests are very valuable, particularly in acute febrile cases where the titer may run quite high. The highest in my experience was 1/10,000. Early in the course of the disease it is usually negative and becomes positive after one to three weeks. In some cases the agglutinins never develop, and the disease runs a full course without ever having a positive agglutination test. In one case which was repeatedly tested during an acute illness lasting seven weeks the agglutination test was always negative. Twelve weeks later the fever entirely subsided, but the patient was still quite weak and easily exhausted. The agglutination test was negative, but the skin sensitization test was very strongly positive and produced a marked relapse of all the symptoms. During the last summer I saw three cases in which all of the symptoms suggested brucellosis. However, all tests for any type of fever were entirely negative, and the patients eventually recovered. The question arises whether or not we were dealing with brucellosis or some new type of infectious disease. The fact that cases have been reported in which all tests have been negative with the exception of positive blood cultures leads us to believe that both the agglutination test and the skin test can remain negative at all times in this disease. Brucellosis must still be suspected in spite of the fact that all laboratory tests remain negative. Fever of any cause such as from an acute upper respiratory infection may bring out agglutinins in chronic cases which may last for several weeks; these can also be provoked by the use of intravenous typhoid vaccine. I believe that a provocative test with typhoid vaccine should constitute one of our diagnostic methods. Unfortunately a skin test is usually done first, and the instillation of even a small amount of vaccine or brucella allergen may produce antibodies. However, when there is no severe reaction to the skin test making the provocative test desirable, it is unlikely that these immune substances would be stimulated to the point of confusion.

If the agglutinins develop and the agglutination test is positive, the length of time that these remain, after the disease has subsided, varies greatly. In some cases the tests remain positive for a long time in spite of the fact that there is no evidence that the disease has become intermittent or chronic. In other cases the agglutinins disappear rapidly after the acute stage has subsided. In the chronic or intermittent form the agglutination test is most unsatisfactory, as it is usually negative, but in such cases I believe that the provocative test with typhoid vaccine should be a standard test and should be made before the skin test.

The skin test can be performed either with protein of brucella or with the vaccine. At the present time, we use 1/10 cc. of Lederle's vaccine injected intracutaneously and read this test at the end of 24 and 48 hours. Many cases show a local reaction at the end of 24 hours which usually subsides completely at the end of 48 hours in negative cases. If

the test becomes progressively severe during the 24 to 48 hour period, it constitutes an important point of interpretation. The skin test is probably our most valuable single test especially in the chronic state, but it certainly is not infallible. There are definite false positives. The patient may get a fairly severe reaction from sensitivity to the protein, and it is almost impossible to differentiate such reactions from the real positive. There are also false negatives. One patient who passed through an acute stage of brucellosis with marked respiratory symptoms and an agglutination test of 1/10,000 had an entirely negative skin test.

In general the skin test is reliable and should be reserved until all other tests have been completed in order to avoid false immune reactions. In interpreting the positive skin test it is a question of whether the disease is active or whether the positive reaction represents an immunity. I make a definitely positive diagnosis only in those cases which show very strongly positive local reactions and in whom there is also usually a general reaction with lymphangitis, adenitis, a rise in fever, and possibly the reproduction of some of the symptoms of which the patient has complained. When such a reaction is present, I believe that it undoubtedly means active disease. The opsonocytophagic index has been devised to distinguish these conditions, but in my experience is not nearly so efficient as would be desirable.

The opsonocytophagic index which was devised by Huddleson is a test of the power of freshly drawn white corpuscles to phagocytize a suspension of brucella organisms in vitro. Varying degrees of phagocytosis indicate the stages of susceptibility, infection, or immunity. It is not strictly a diagnostic test and should be used especially in conjunction with the skin test to determine the degree of immunity. My chief criticism of this method is its questionable accuracy in determining which cases are immune as it seems to give too high a percentage of immunity. I have observed this in some cases in which the disease undoubtedly continues to be active clinically. This test has also been found wanting in determining the amount of treatment.

The animal inoculation method of diagnosis is very reliable and is comparable to the methods used in animal inoculation for tuberculosis. The chief criticism of this method is that it is rather slow and is a very dangerous source of infection to laboratory workers.

As previously mentioned the order of making diagnostic tests is very important. It is highly advisable not to do a skin test until the agglutination and provocative agglutination tests have been done, because of the danger of producing falsely positive agglutinin reactions which forever make the diagnosis of this disease impossible by present methods.

The differential diagnosis of brucellosis is beyond the scope of this discussion. A list of some of the diseases from which this disease must be differentiated indicates the difficulties in the differential diagnosis.[1]

1. Influenza
2. Pneumonia
3. Typhoid
4. Paratyphoid
5. Malaria
6. Tuberculosis
7. Acute rheumatic fever
8. Subacute bacterial endocarditis
9. Septicemia
10. Tularemia
11. Typhus
12. Kula agar
13. Relapsing fever
14. Infectious mononucleosis
15. Syphilis
16. Lymphoblastoma
17. Bronchitis
18. Bronchiectasis
19. Bronchial asthma
20. Sinusitis
21. Cholelithiasis
22. Cholecystitis
23. Appendicitis
24. Peptic ulcer
25. Ulcerative colitis
26. Nephritis
27. Pyelitis
28. Cystitis
29. Ovarian tumor
30. Menopause
31. Sciatica
32. Low back pain
33. Osteomyelitis
34. Neurasthenia
35. Psychoneurosis
36. Hysteria
37. Insanity
38. Five kinds of skin disease

This sounds very much like the list of diseases in the old ads for patent medicine which could be cured by its magic properties. This list is exaggerated but not far from the truth and is the chief reason for the lack of case reports in this article as so few cases are ever alike. This disease must be considered in general terms, as one does tuberculosis and syphilis, and as affecting any part of the body.

Although the diagnosis of this disease is considerably difficult, the treatment as compared with the diagnosis presents even greater problems.

Methods of Treatment. The expectant and supportive type of treatment is used in many types of infection without known specific cause, or in diseases of known etiology without specific treatment such as typhoid fever and tuberculosis. In acute cases of brucellosis general support of the patient with fluids, adequate food, and the relief of distressing symptoms is often all that is necessary, and many patients completely recover without recurrences. I think a great many cases of this type must occur which are unrecognized and undiagnosed and get entirely well.

If the disease progresses to the intermittent or chronic form, it is rather unlikely that it will subside with time, and if it does, will cause much disability in the process. Accordingly the methods of treatment should be considered more often in the chronic than in the acute form. However, rest and general supportive measures must not be neglected in the chronic form in addition to the more specific types of treatment.

Immune sera, either the prepared type or sera from recovered cases, should be reserved for acute cases, primarily for those which are likely to result fatally, namely, those with involvement of the central nervous system. The reports are not encouraging enough at the present time to advise it in the routine treatment of acute cases. However, we have reason to believe that sera can be greatly improved and will eventually be of very specific value.

Vaccine or brucella protein may be given either in the acute or the chronic stage and, in my opinion, constitute the best form of treatment at the present time. The great objections to it are that it is quite severe in its reactions and local sterile abscesses may ensue. During the period of treatment, the patient is likely to be made much worse from the standpoint of symptoms and feeling-tone. It is particularly contraindicated in cases of central nervous system involvement. However, patients who are able to stand unusually severe reactions get the best results.

I question the use of vaccine or brucella protein in doubtful cases as it brings out the agglutinins in the blood, and makes it impossible ever to determine whether or not the patient really has undulant fever. Some physicians have a rather bad habit of testing the effect of vaccine treatment on many chronic disease states without having made careful diagnostic tests. If the vaccine method had very specific therapeutic effects this method could not be criticized, but the specificity of the treatment is not great enough in my opinion to counteract the serious objection previously mentioned. Also, in mild chronic diseases the treatment makes the patient feel worse than the disease, and general rest and supportive measures give good results.

If this treatment is not effective or only partially effective, nonspecific methods of treatment may be used in recurrent or chronic forms, particularly fever therapy either with typhoid vaccine or artificial fever. This again should not be used in the acute stages. I prefer this type of treatment in doubtful cases rather than vaccine treatment because falsely positive tests are not likely to be produced, and the use of typhoid vaccine and artificial fever frequently brings out high agglutinins in the blood definitely to establish the diagnosis.

In this day of miracles with chemotherapy, one would expect that some of the sulfonamides would produce results as brilliant as they have in other infectious diseases. Some reports in the literature have been encouraging, but in my experience the drugs are useless except when they produce a severe drug reaction, and in these cases the patients have done unusually well. The benefits, however, are not due to the drug but to the general shake-up of the system similar to that produced by the use of vaccine or fever. I believe that the favorable reports in the litera-

ture are the result of false observations and are spontaneous cures or those cases which have a drug reaction. Possibly our best hope is in the development of some new drug, but at this time chemotherapy is not encouraging.

The removal of a local focus of the brucella organism may give good results, such as the drainage of an ovarian abscess or the removal of a gallbladder. The possibility of such a focus should be especially considered in chronic or undulating brucellosis after an acute episode. Since the instillation of brucellergin or vaccine in very small amounts causes a recurrence of symptoms and at times severe reactions, patients should avoid taking brucellergin by mouth. Certain phenomena suggest that even the drinking of pasteurized milk from an infected herd or the ingestion of meat containing the brucellergin may be the exciting factor in a flare-up of symptoms.

The best prophylaxis at the present time in the pasteurization of milk and in avoiding direct contact with infected materials. Vaccination for the control of this disease will probably come into effect much the same as vaccination for typhoid. Certainly the vaccination of persons constantly exposed to this disease should be attempted, and its effects studied. Unfortunately, the morbidity is so much higher than the mortality that adequate measures have not been taken to control it.

The prognosis is good as far as life is concerned. The mortality rate is between 2 and 5 per cent, and most of these cases have central nervous system involvement. The prognosis is also reasonably good for complete recovery in acute cases, but in the intermittent or chronic type, relief of symptoms and partial improvement is all that can be expected. The patient seldom regains his former state of health. Results from treatment in the chronic stage are even more difficult to evaluate because of the greater uncertainty in diagnosis. For this reason I am inclined to favor supportive measures of very chronic cases similar to those used in chronic tuberculosis.

The greatest question to decide in any given case is when to discontinue treatment. In general the subjective well-being of the patient is the best indication for stopping treatment. Vaccine treatment, however, must be intermittent, otherwise the patient will steadily feel worse. Usually patients do not begin to feel better until treatment has been disdiscontinued. As previously indicated I do not believe that opsonocytophagic index study gives us a clue as to the proper time to discontinue therapy.

SUMMARY

The difficulties in the diagnosis and treatment of brucellosis are obvious. The clinical picture is very similar to that of many other

diseases, and the diagnostic tests are subject to error both in a positive and negative way. We lack specific therapy which could be used as a diagnostic method, and the present methods of treatment are far from being satisfactory. A case with a questionable diagnosis, subjected to long severe treatment in which we do not have too much confidence, is discouraging when it is the general lay belief that all that is needed for a cure is the establishment of a correct diagnosis. The disappointment of many of these patients when they learn that the treatment is sorely limited, although their disabling illness has been definitely diagnosed, is certainly shared by their physician.

Until brucellosis is better controlled we should consider this disease as a scourge of mankind which is becoming more and more prevalent. It should be regarded as a major health problem, and certainly will be when the demoralizing effects of the chronic morbidity are more definitely established.

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FIBROMAS OF THE OVARY SIMULATING MALIGNANT TUMORS

GEORGE CRILE, Jr., M.D.

Fibromas of the ovary are benign tumors, their removal is attended by little risk, and the operation is followed by complete and permanent alleviation of the patient's symptoms. Because prior to operation the syndrome is frequently interpreted as being the result of an extensive pelvic malignancy, the dramatic reversal of a poor prognosis and the patient's complete recovery are exceptionally gratifying to both patient and physician.

Fibromas of the ovary may be divided into two groups. (1) The small, symptomless, "incidental" fibromas, 1 or 2 cm. in diameter, which are found in the course of laparotomies, are of no clinical significance and will not be discussed. (2) In the second group are the rapidly growing fibromas of the ovary which attain large size with surprising rapidity, and occur characteristically in patients well beyond the menopause. They tend to produce ascites or to become twisted on their pedicles and form a large, fixed, tender mass in the pelvis. Because these tumors occur in women of the "cancer age" and grow so fast that it seems inconceivable that they could be benign, and because they are frequently associated with ascites and fixation of the tumor mass, it is little wonder that at first such tumors are frequently thought to be malignant and are only recognized as benign at operation.

The latter type of fibroma of the ovary is not common. In the last twelve years, only seven such tumors have been removed at the Cleveland Clinic Hospital. In each instance the patient has been over 50 years of age.

According to the symptoms produced these tumors may be divided into three groups.

Group 1. The first type is the painless, rapidly enlarging, abdominal tumor which feels like a fibroid on examination, but tends to be harder and does not seem to be attached to the uterus. In one instance a tumor nearly as large as a football was found in an elderly woman who had had a pelvic examination by a competent physician less than four years previously and had been told that the pelvis was perfectly normal at that time. In other instances the patients themselves have noted the extreme rapidity with which the tumors enlarge. The sudden appearance and rapid enlargement of a hard pelvic mass in a woman in her sixties naturally cannot fail to arouse the suspicion of malignancy.

Case 1. A married woman, aged 67, complained of constipation and indigestion. Upon examination the entire pelvis was found to be filled with a large nodular mass. It

could not be determined whether this mass arose from the uterus or adnexa. The patient gave a history of having had a normal pelvis upon examination four years previously by a competent physician, who confirmed the report.

In view of the rapid enlargement of the tumor a malignancy of the ovary was suspected, and operation was advised. At the time of operation a fibroma of the right ovary, weighing 417 grams, was found. The patient has been well since the operation.

Group 2. The symptoms produced by the second category of fibromas of the ovary result from torsion of the pedicles. As a rule the patient complains of abdominal pain. These tumors do not tend to be adherent, and their pedicles are often long. It is not surprising, therefore, that the tumor tends to rotate in the abdomen with associated torsion of the pedicle and interference with the blood supply of the tumor. When this occurs, the tumor becomes necrotic and adherent to the pelvic peritoneum, and upon pelvic examination a hard, fixed, slightly tender mass is found to fill the pelvis. In these cases a hard, fixed, degenerating fibroma of the ovary may be almost indistinguishable from the so-called "frozen pelvis" associated with advanced carcinoma of the pelvis.

Case 2. An unmarried woman, aged 64, complained of abdominal distention and pain, constipation and weakness. A diagnosis of carcinoma of the colon had been made on the basis of roentgenograms at another hospital. On pelvic examination a large, fixed, tender mass was felt. Proctoscopic examination was normal, and x-ray of the colon showed some deformity from an extrinsic tumor and a few small diverticula. A diagnosis of probable extensive pelvic carcinoma was made, and exploratory operation was advised.

Upon exploration a fibroma of the ovary with a twisted pedicle was found. The tumor which was undergoing necrosis was fixed to the pelvic peritoneum by rather firm adhesions and was so wedged into the pelvis that it was difficult to mobilize.

Following removal of the tumor the patient had an uneventful convalescence and has had no further difficulty. The tumor was described histologically as a fibroma and weighed 560 grams.

Group 3. In the third category are those patients who develop ascites as a result of fibromas of the ovary. This syndrome was first reported by Meigs[1], and in several of his cases he observed not only ascites but also hydrothorax. In only two cases in our series was ascites noted, and hydrothorax did not occur.

As a general rule, ascites associated with a hard pelvic tumor indicates the presence of advanced carcinoma with implantation on the peritoneal surfaces. Therefore, it is particularly gratifying to find that the ascites in these cases is caused by a benign and curable condition, and that following the removal of the fibroma, does not recur. The exact cause of the ascites is not known, but it is possible that some circulatory disturbance increases the venous pressure in the tumor with a resultant filtration of serum from the serous surfaces. The following case is illustrative of ascites from a fibroma of the ovary.

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In view of the rapid enlargement of the tumor a malignancy of the ovary was suspected, and operation was advised. At the time of operation a fibroma of the right ovary, weighing 417 grams, was found. The patient has been well since the operation.

Group 2. The symptoms produced by the second category of fibromas of the ovary result from torsion of the pedicles. As a rule the patient complains of abdominal pain. These tumors do not tend to be adherent, and their pedicles are often long. It is not surprising, therefore, that the tumor tends to rotate in the abdomen with associated torsion of the pedicle and interference with the blood supply of the tumor. When this occurs, the tumor becomes necrotic and adherent to the pelvic peritoneum, and upon pelvic examination a hard, fixed, slightly tender mass is found to fill the pelvis. In these cases a hard, fixed, degenerating fibroma of the ovary may be almost indistinguishable from the so-called "frozen pelvis" associated with advanced carcinoma of the pelvis.

Case 2. An unmarried woman, aged 64, complained of abdominal distention and pain, constipation and weakness. A diagnosis of carcinoma of the colon had been made on the basis of roentgenograms at another hospital. On pelvic examination a large, fixed, tender mass was felt. Proctoscopic examination was normal, and x-ray of the colon showed some deformity from an extrinsic tumor and a few small diverticula. A diagnosis of probable extensive pelvic carcinoma was made, and exploratory operation was advised.

Upon exploration a fibroma of the ovary with a twisted pedicle was found. The tumor which was undergoing necrosis was fixed to the pelvic peritoneum by rather firm adhesions and was so wedged into the pelvis that it was difficult to mobilize.

Following removal of the tumor the patient had an uneventful convalescence and has had no further difficulty. The tumor was described histologically as a fibroma and weighed 560 grams.

Group 3. In the third category are those patients who develop ascites as a result of fibromas of the ovary. This syndrome was first reported by Meigs[1], and in several of his cases he observed not only ascites but also hydrothorax. In only two cases in our series was ascites noted, and hydrothorax did not occur.

As a general rule, ascites associated with a hard pelvic tumor indicates the presence of advanced carcinoma with implantation on the peritoneal surfaces. Therefore, it is particularly gratifying to find that the ascites in these cases is caused by a benign and curable condition, and that following the removal of the fibroma, does not recur. The exact cause of the ascites is not known, but it is possible that some circulatory disturbance increases the venous pressure in the tumor with a resultant filtration of serum from the serous surfaces. The following case is illustrative of ascites from a fibroma of the ovary.

Case 3. A woman, aged 56, complained of a burning pain in the right costal margin of fifteen years' duration, and of constipation of six months' duration. In addition, she had noticed that her abdomen was increasing in size.

On abdominal examination a large, very hard, movable tumor was found which apparently arose from the pelvis. Ascites was present as indicated by shifting dullness and the examiner's ability to ballotte the tumor. A preoperative diagnosis of fibroma of the ovary was made.

At operation a tumor weighing 1,770 grams was removed which was described histologically as a fibroma. The patient had an uneventful convalescence and has had no difficulty since operation.

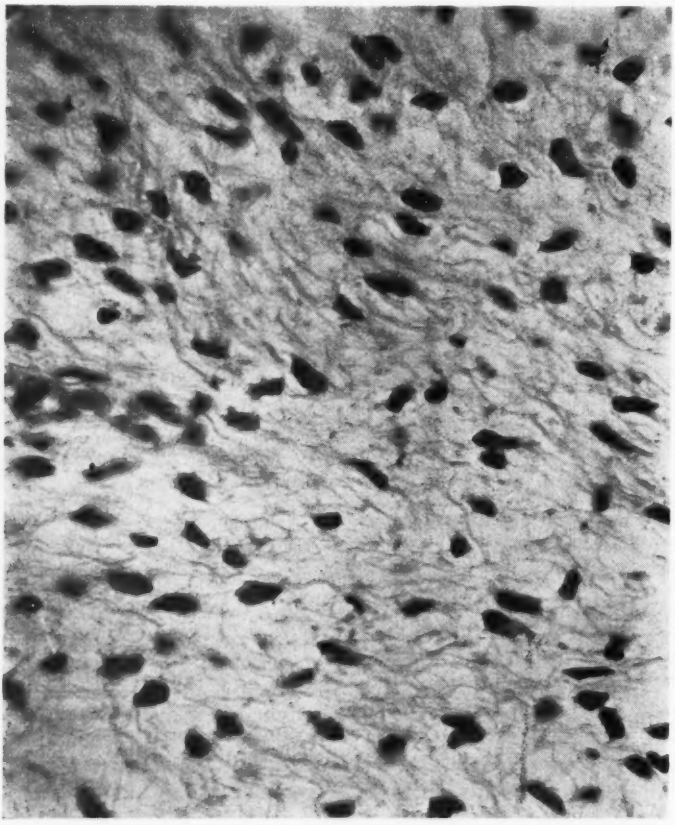

FIGURE 1. Photomicrogram showing histology of a fibroma of the ovary in Case 3.

The clinical and pathologic features of fibroma of the ovary are hard to reconcile. These tumors behave clinically like carcinomas in that they occur in the aged and grow rapidly, yet histologically they seem to be perfectly benign and, in our experience, neither recur nor

metastasize. Some writers[2] raise the question as to whether many of these "fibromas" are not really benign tumors of epithelial origin. I am not qualified to discuss the pathologic aspects of this question except to say that the tumors in our series contained no epithelial elements demonstrable by ordinary staining methods. On the other hand, the rapid growth and the age incidence of fibromas of the ovary could be better explained if they could be demonstrated to be of epithelial origin.

Regardless of the true nature of fibromas of the ovary, it is important to remember that on exploration an apparently advanced and incurable malignancy of the pelvic organs may prove to be a benign and curable tumor of the ovary. In the presence of ascites or fixed pelvic masses of undetermined origin, or of the sudden development of a rapidly enlarging abdominal tumor in an elderly woman, the possibility of a fibroma of the ovary must be considered.

SUMMARY

1. Fibromas of the ovary characteristically occur in elderly women.

2. Fibromas of the ovary may enlarge so rapidly that the presence of a malignant tumor may be suspected.

3. Fibromas of the ovary may produce ascites and accordingly suggest the presence of malignancy.

4. Fibromas of the ovary may become twisted on their pedicles and form a hard fixed mass in the pelvis which simulates extensive metastasis from a carcinoma.

5. Fibromas of the ovary are easily removed and do not recur.

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BRONCHOLITHIASIS

Report of Two Cases

H. S. VanORDSTRAND, M.D., PAUL M. MOORE, Jr., M.D.
and H. E. HARRIS, M.D.

In patients presenting the symptoms and physical findings of partial to complete bronchial obstruction, a broncholith should be considered as a possible etiologic factor in addition to the two entities usually considered, namely, an aspirated foreign body or a bronchial tumor.

In its strictest sense the term broncholithiasis refers to the formation of calculi in a bronchus. It is the accepted diagnostic term for patients having bronchial stones, although in the majority of cases the calculus originally develops extrabronchially, for which reason a few authors in the literature mention pneumoliths, pulmoliths, and lung calculus or lung stone. As the majority of patients with broncholithiasis frequently experience an asthmatoid type of wheeze, the term stone asthma is also used. Patients who are able to expel these stones by themselves experience a severe paroxysmal type of cough which the French have accurately described as "colique bronchique". The occurrence of "lung stones" has been recognized since the days of Aristotle and Galen, but a comprehensive clinical report did not appear until Schenck[1] recorded his observations in 1600.

The entity is not very common as is indicated by the fact that Lloyd[2] found only 18 cases reported in the English literature between 1900 and 1930. Lloyd reported four cases in 1930, and since that time only four additional cases of broncholithiasis have been reported in the English literature. In the majority of these the diagnosis was made after the patient had expelled the stone himself. In most instances only a single or a few calculi were expelled, although one patient coughed up 400 broncholiths in his lifetime.

Broncholithiasis develops when a calcareous deposit gains entrance into, or forms in, the lumen of the bronchus and may, therefore, be either of peribronchial or of endobronchial origin. As has been previously mentioned those gaining entrance into the bronchus from without are of much the greater frequency. A considerable number have been proved to be of tuberculous origin in the form of a calcification of a peribronchial or peritrachial lymph node. In other instances the calcareous extrabronchial formation may be due to other types of lung infection, such as pneumonia or previous lung abscess, and in some instances to a previous pulmonary infarction. Endobronchial calcareous formations may be caused by irritation and inflammation as a sequela

of previously aspirated foreign bodies from without, or as a piling up of further calcareous formations from aspirations into the lower respiratory tract of rhinoliths or tonsiliths from the upper respiratory tract.

Why the lung is such a frequent site of calcareous formation has never been completely explained. Long before biochemical analysis postmortem observers marveled at man's ability to form stones from soft tissues, but even since the advent of biochemistry our knowledge of the processes by which calcareous deposits are formed has been very limited. Chemically, with few exceptions, these pathologic deposits are quite similar to normal bone, 85 to 90 per cent calcium phosphate and 10 to 15 per cent calcium carbonate. Wells[3] shows the close similarity between calcification and ossification. His opinion, which Harbitz[4] concurs, is that the processes differ only morphologically, the calcium deposit in calculi being at first in granulous form, although later it may become homogeneous through fusion. Wells states that "within such deposits there are usually no living cells and no further changes take place unless it be absorption or the addition of more calcium salts." Calcium salts, according to Wells, are absorbed to a greater extent than can be held in solution by the arterial blood, so that no calcium is found deposited in the right side of the heart. However, after the blood passes through the lungs and loses a large part of its carbon dioxide, the calcium salts are precipitated in the pulmonary veins, the left heart, and are taken up by adjacent tissues.

The symptoms and clinical picture of broncholithiasis depend upon the extent of bronchial obstruction. With residual obstruction the patient may have only a chronic or paroxysmal cough. Obstruction of the bronchus produces atelectatic and inflammatory changes, and thus the findings may be those of pneumonitis, atelectasis, bronchiectasis, or lung abscess, with a history of bouts of fever and even occasional hemoptysis. With partial obstruction the patient frequently notes an asthmatoid type of wheezing.

In the past the diagnosis of broncholithiasis usually has been made after the stone has been brought up with a fit of coughing. The patient may be seized with an attack of coughing, expiratory dyspnea, and marked loud wheezing very closely resembling an asthmatic attack. Hemoptysis of varying degree may or may not follow the attack. In the absence of a history of expelling a stone the diagnosis may be suspected roentgenographically but confirmed bronchoscopically.

Treatment consists of measures directed toward dislodging the bronchial calculus. At present there is no known way of preventing a recurrence. If the stone is not easily removable through the bronchoscope, it should only be manipulated gently as this procedure is not without danger. Pneumothoraces have occurred during attempted

bronchoscopic removal of broncholiths which initially formed extrabronchially without having gained complete entrance into the broncholumen. If the calculus can be only partially dislodged by the bronchoscope, expectorants and postural drainage exercises often help the patients to expel the stone. Chemotherapy is indicated in patients having clinical evidence of some form of suppurative pneumonitis behind the bronchial obstruction. Thoracic surgery such as subtotal lobectomy, lobectomy, or pneumonectomy may be indicated where long standing bronchial obstruction has led to irreparable damage, particularly in marked cicatricial bronchostensis and bronchiectasis.

REPORT OF CASES

Case 1. A 59 year old executive registered for the allergy department on October 31, 1941 with the chief complaints of a chronic cough and "attacks of asthma" which had been present for twelve months. Associated with the cough and episodes of wheezing he had occasional bouts of low grade fever. His expectoration was ordinarily mucoid and very minimal except when he experienced a fever, at which time it would become more productive and purulent, but he had never experienced hemoptysis.

The positive findings on the physical examination were confined entirely to the chest. A decreased percussion note was noted at the right base posteriorly between the levels of the eighth and tenth dorsal spines along with decreased breath sounds in this same area. Some diminution in breath sounds was noted over the right lower anterior chest as well. The temperature was normal at the time of the examination. Roentgen examination of the chest (Fig. 1) revealed a right deviation of the lower end of the trachea with partial atelectasis in the right lower lobe and a minimal degree of shifting of the lower mediastinum to the right. Calcifications in the right lower lung and right hilar region were not considered to be of clinical significance at the time.

A bronchoscopic examination revealed a calcific mass almost obstructing the right main stem bronchus just above the middle lobe orifice. This was partially removed with the grasping forceps. The patient was sent home to return in one week for another bronchoscopy.

Because of an exacerbation of symptoms upon his return he entered the hospital. The bronchoscopic procedure was repeated, and one relatively large calcific mass and several small pieces were removed. No further broncholiths were observed. After the large stone had been removed, a large amount of pus was released.

The patient remained in the hospital for nine days with continuous elevation of the foot of his bed, expectorants, postural drainage exercises, and sulfathiazole (the blood level being maintained at approximately 3 to 4 mg. per cent). On these measures all of his symptoms subsided, and he was entirely symptom free the last five days of his stay.

A progress roentgen examination of the chest on November 12 showed that the atelectasis had cleared, although a small area of calcification could still be observed in the area from which the broncholiths had been removed bronchoscopically (Fig. 2). For this reason another bronchoscopy was done which revealed one medium sized broncholith which could be manipulated, but not extracted. The patient was discharged on expectorants and postural drainage exercises. One week after returning home he expelled the calculus himself. Fig. 3 shows the broncholiths of this case.

The patient returned in four weeks and stated that he felt fine in all respects and was entirely symptom free. Physical examination of the chest revealed no abnormalities of any kind. However, it seemed advisable to make a lipiodol bronchogram of the right middle and right lower lobes to exclude bronchiectasis because the previous symptoms

had suggested bronchial obstruction of one year's duration. The bronchograms revealed an entirely normal tracheobronchial tree. In addition blood calcium, phosphorus, cholesterol, and phosphate determinations revealed normal values.

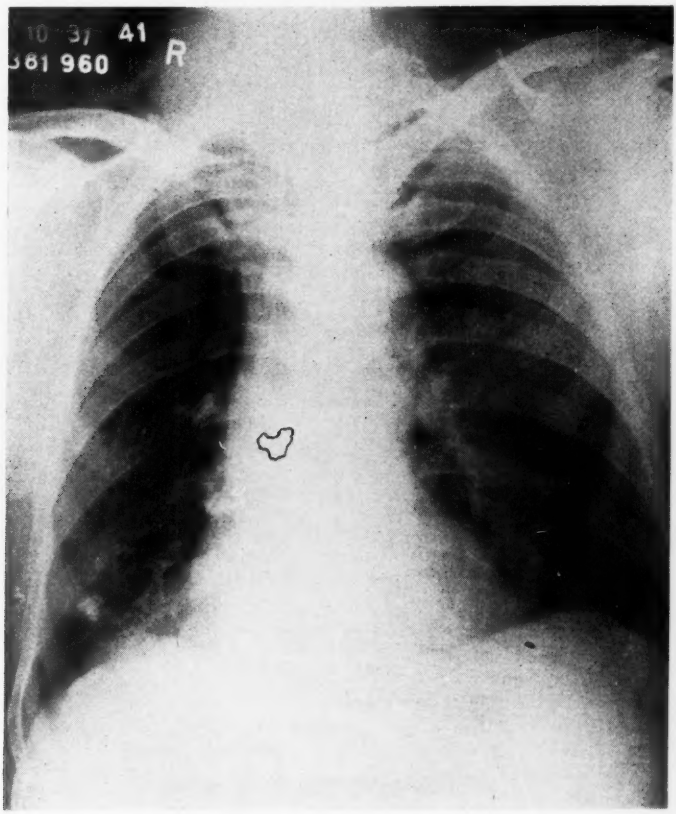

FIGURE 1: Initial x-ray of Case 1. Area of calcific mass encircled. Originated extrabronchially to produce partial bronchial obstruction through eroding bronchial wall.

COMMENT

This case illustrates the value of bronchoscopy in the diagnosis of broncholithiasis as this patient had never expelled a calculus prior to his initial examination. The symptom complex was typical of stone asthma. In addition he experienced true bronchial colic in expelling the last broncholith. The etiology of the broncholithiasis was not determined, although both bronchoscopy and roentgenograms indicated that his calcifications were primarily of extrabronchial origin eroding into the bronchus.

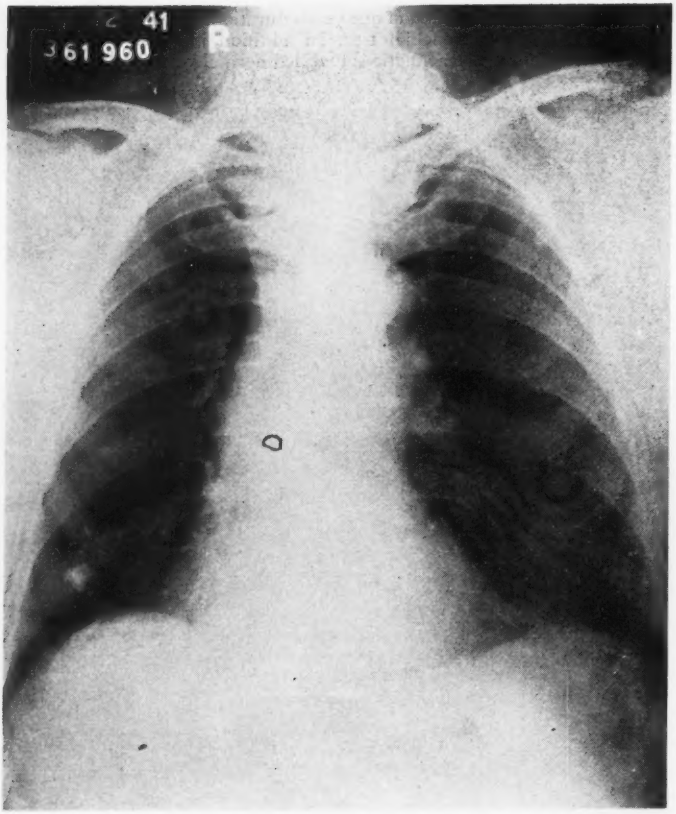

Figure 2: Later x-ray of Case 1 after part of broncholiths have been removed bronchoscopically. Remaining stone expelled by patient.

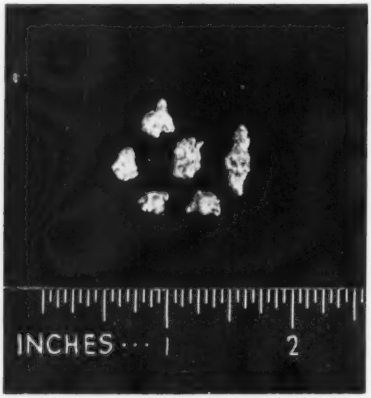

Figure 3: Broncholiths of Case 1. Largest was expelled by patient. Others removed bronchoscopically.

Case 2. A 55 year old employee of an electric company came to the Clinic on July 11, 1941 presenting the symptoms of "recurrent attacks of flu" for the past four years. The attacks consisted of episodes of cough, productive of several ounces of purulent sputum, which were associated with chills and fever and lasted one to two weeks at intervals of every four to six months. In the previous six months, however, the attacks had occurred more frequently and had incapacitated him during the previous six weeks. He had lost 8 pounds in weight in the last six months.

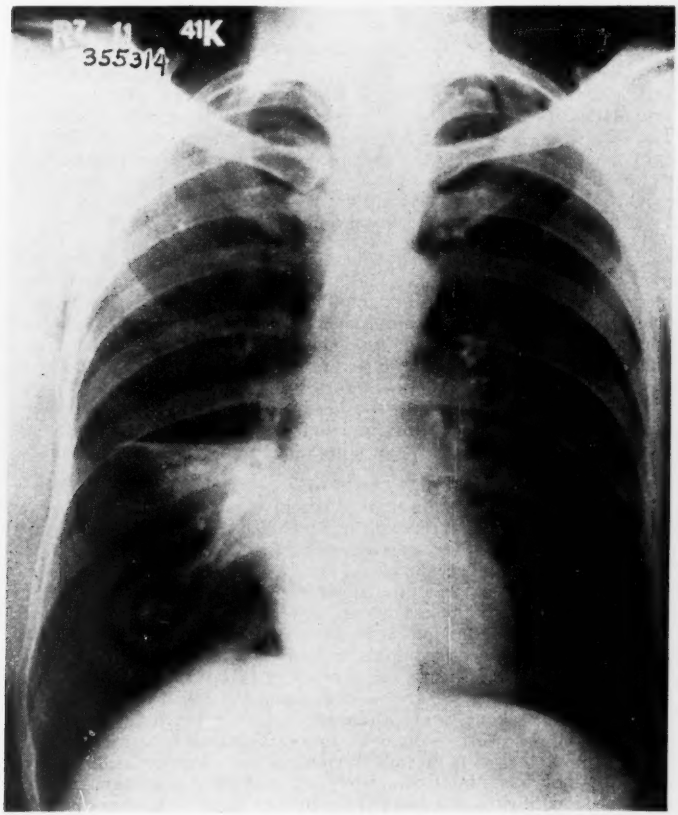

FIGURE 4: Preoperative x-ray of Case 2.

The only abnormalities were confined to the chest. Roentgen examination (Fig. 4) revealed partial atelectasis of the right middle lobe. At least one small abscess was discernible stereoroentgenographically in the area.

On the following day a bronchoscopic examination was carried out, and the right middle lobe bronchus was found to be constricted near its orifice to about ¼ its normal size. A thick grayish-yellow pus could be aspirated beyond the area of constriction. There was no ulceration nor other evidence of neoplasm. A biopsy was obtained from the mucosa in the right middle lobe bronchus in the area of stenosis. Microscopic study

of this biopsy showed only chronic non-specific inflammatory reaction with no evidence of neoplasm. Bacteriologic study on smear and culture of the bronchoscopically aspirated mucopurulent secretion revealed no pathogens. The patient entered the hospital on July 23, 1941 for further study relative to the etiology of his bronchostenosis (right middle lobe). On the following day bronchoscopy was repeated, and again nothing was found to account for the stenosed bronchus. However, immediately following manipulation in the area of stenosis, the patient developed a sudden severe pain in his right chest which proved to be due to pneumothorax. He gained no relief from morphine and was made comfortable only after 1800 cc. of air was aspirated into the chest wall. His convalescence from the complicating pneumothorax was uneventful.

As we were unable to determine the etiology of the bronchostenosis, and particularly as we were fearful of primary bronchogenic neoplasm, an exploratory thoracotomy was carried out on August 7, 1941. Dr. T. E. Jones made a transverse space between the third and fourth ribs extending from the right border of the sternum to the midaxillary line. The wound was spread with retractors without dividing the ribs. The right lower and right middle lobes were found collapsed, and the right upper lobe was densely adherent to the chest wall, especially anteriorly. Dense adhesions to the medial border of the right middle lobe of the pericardium were noted, and all adhesions were freed. There was no palpable evidence of neoplasm.

Because of the dense interlobar adhesions and the atelectasis of both the middle and lower lobes, total pneumonectomy seemed to be the wisest procedure. The superior and inferior pulmonary veins were doubly ligated and divided. The pulmonary artery was doubly ligated with double strands of black silk and divided. The main stem bronchus was clamped and divided, and the entire right lung delivered intact. The bronchus was closed with multiple interrupted sutures with No. 35 steel alloy wire. Three grams of prontylin powder was dusted in the pleural cavity. The third and fourth ribs were approximated with two heavy steel alloy sutures through drill holes. The pectoral muscles were approximated with figure of eight catgut sutures, the superficial facia approximated with fine catgut sutures, and the skin closed with running dermal locked sutures.

The pathologic report on the surgical specimen is as follows: The gross specimen consisted of the right lung with three distinct lobes weighing 450 grams. Firm adhesions obliterated the upper half of the sinus between the upper and middle lobes. There were extensive fibrous adhesions over the lateral surface of the upper lobe with areas of plastic exudate upon the plural surface of the upper lobe and upon the base of the lower lobe. Examination of all the bronchioles going to the upper, middle, and lower lobes disclosed no neoplasm, and no tumor nodules were discovered in the lung. In the bronchus of the middle lobe was an area of incomplete stenosis through cicatrization in the wall of the bronchus. This occurred at the site of origin of one of the smaller bronchi passing through the upper portion of the middle lobe. External to the bronchus at this site was a hard calcified nodule about 1 cm. in diameter which might have been an old healed tubercule. The mucosal surface opposite the calcified nodule was irregular, granular, and appeared to be the site of an inflammatory process. The bronchiole for the upper portion of the lobe was almost completely occlused by this inflammatory tissue and cicatricial reaction. Slightly distal to this site in the fork of the smaller bifurcation was a small calcified nodule about 4 mm. in diameter apparently causing no stenosis. Several small subpleural calcified nodules were present in the middle and upper lobes. Impression was incomplete stenosis of the middle lobe bronchus probably incidental to calcified extrabronchial tubercles. Microscopic sections of the bronchiolar walls showed obsolete caseous tubercules in the peribronchial lymph node with erosion into the bronchiole and ulceration of the mucosa. There was considerable granulation tissue and acute inflammation of the mucosa and nodule. There was no histologic tuberculin, nor giant cells. Conclusion: Incomplete stenosis middle lobe bronchus, caseous and tuberculous peribronchial node with ulceration in the middle lobe bronchus.

The patient experienced a very uneventful postoperative convalescence. His temperature never rose more than 1½ degrees at any time, and he was discharged on

the twenty-second postoperative day. His subsequent progress continues to be excellent, and he is well and symptom free. Fig. 5 demonstrates the last progress postoperative film, at which time the patient was symptom free, and his pneumonectomy uncomplicated by empyema.

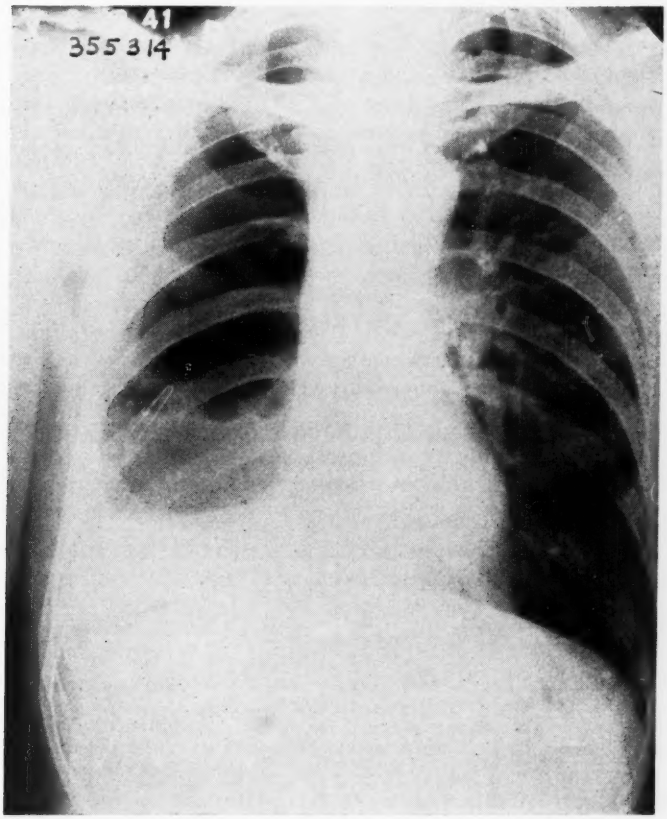

FIGURE 5: Postoperative x-ray of Case 2 (ten weeks later). Pneumonectomy for bronchostenosis secondary to broncholithiasis.

COMMENT

In this patient the broncholith was definitely of extrabronchial origin in the form of a partially calcified tuberculous gland with the complicating factor producing bronchostenosis and irreparable damage to the obstructed lung lobe beyond. This case also illustrated the com-

plication of pneumothorax in bronchoscopic manipulation in broncholithiasis. Although the diagnosis was not established until after surgery, this form of treatment proved to be the correct one.

SUMMARY

1. Broncholithiasis must be considered in the diagnosis of cases in which the history and findings suggest bronchial obstruction.

2. Bronchoscopy is essential for accurate diagnosis in these cases.

3. Broncholithiasis arises from calculous formations endobronchially or extrabronchially (with secondary erosion into the bronchus).

4. Two case reports illustrating the latter are presented; in one bronchoscopy was the method of diagnosis and treatment, and in the other lung surgery.

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BENIGN GASTRIC TUMOR

Case Report of Neurofibroma

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Benign tumors of the stomach are of relatively uncommon occurrence in our experience, as well as upon the basis of reports in the literature. They are seen with sufficient frequency, however, to warrant consideration if certain findings are present in the clinical course and in the roentgen examination. As with any gastric tumor it is not only the roentgenologist's responsibility to make a diagnosis of neoplasm, but every effort should be made to determine whether the tumor present is benign or malignant. Although this is not always possible, accuracy in the diagnosis of gastric lesions improves with the use of the newer developments in roentgen examination as well as with the use of other new diagnostic aids.

Three gastric neurofibromata have been seen at the Cleveland Clinic within the past year. In all of these cases the tumor has been removed surgically, and it has been possible to make a final histologic diagnosis. One of these cases had been followed for approximately one year before operation and had progress examinations, both roentgen and gastroscopic.

We wish to report this case in detail because of its diagnostic features, as well as to show the roentgen appearance of the other two neurofibromata.

CASE REPORT

The patient was a man, aged 64, who was first seen at the Clinic in March, 1939. The gastrointestinal complaints at that time were inability to eat heavy and fried foods without abdominal distress, gas, bloating, etc. These symptoms had persisted for several years. At the time of the first admission, there was no history of tarry stools. There had been a recent weight loss of 5 pounds.

The past history revealed that in 1923 the patient had had an operation for the removal of kidney stones, apparently from the left ureter or kidney. He had been told that at the present time there were several small stones in each kidney, although no symptoms were referable to these calculi.

The physical examination was negative except for a small, left inguinal hernia.

The laboratory examination was essentially normal. The urine had a specific gravity of 1.019 and was negative for sugar and albumin. The blood examination was as follows: 4,700,000 red blood cells; 91 per cent hemoglobin; and 8,100 white blood cells. Both the Wassermann and Kahn reactions were negative. The Ewald test meal at the time of the first examination showed a total acidity of 20, but no free hydrochloric acid. The total quantity aspirated was 30 cc., and neither gross nor occult blood could be demonstrated.

Roentgen examination. A preliminary scout film of the abdomen showed a normal lumbosacral region. The right kidney was normal in size, shape, and position with two

opaque shadows in the region of the pelvis. The left kidney was not visualized, but there were several, small opaque shadows in this region. An intravenous urogram made the same day showed a prompt appearance of the dye on both sides. Both kidneys, however, showed a calculous pyonephrosis. The total function was apparently good with some delay in emptying from the left side. In the gastrointestinal series the gallbladder functioned normally with the cholecystographic dye, and no calculi were visualized. The esophagus was normal. The stomach showed a rather large, smooth contoured mass arising from the posterior wall along the greater curvature. This tumor mass was thought to be a benign lesion, although a malignant neoplasm had to be considered. The duodenum was normal, and there was no evidence of organic disease of the colon.

Gastroscopic examination two days after the roentgen examination revealed a mass about the size of a lemon along the greater curvature which was covered with normal mucosa. The impression of the examiner was a benign tumor of the stomach, probably myoma or fibromyoma.

Surgery was considered at this time, but was not urged since the presence of the renal infection made any surgical procedure a rather poor risk. Then, too, there was no definite evidence of malignancy, as both the roentgen and gastroscopic findings were more suggestive of a benign tumor. Hence, operation was deferred at this time, and the patient was to return for progress examination six months later.

The patient returned to the Clinic one year later. His history revealed that his progress had been good for a time and that gradually he had been able to give up all medication. About four weeks previously, however, he had had a severe dizzy spell, and ten days later had had tarry stools for forty-eight hours. He reported that a blood count made at that time had not been affected to any great extent. No symptoms referable to the renal calculi had developed during this interval.

Roentgen examination. The stomach showed a rather well-demarcated tumor in the pars media with an ulcer niche near the superior border. The tumor was larger than when seen one year previously. There was no definite evidence of neoplastic change, but the possibility had to be considered in view of the growth. The duodenum was normal.

Gastroscopic examination. This report was rather lengthy, but was summarized as follows: "I would still consider this a benign gastric tumor, although I am a little puzzled by the apparent growth of the tumor during the past year and the small circumscribed area of mucosal change near the cardia, which may be either a severe gastritis or neoplastic change."

Operation was advised in view of the questionable neoplastic changes and was carried out two weeks after the progress examinations. Palpation revealed a tumor mass in the middle third of the stomach which could be moved about. The operator believed that this was probably a polyp and therefore decided upon a transgastric resection. After incision of the stomach wall, a polyp-like structure approximately 2½ inches in diameter with several areas of erosion on the surface was found and resected. Satisfactory hemostasis was obtained, and the incision in the stomach was closed.

Pathologic report. The specimen consisted of a roughly circular segment of gastric wall weighing 62 grams and measuring 7 by 5.5 cm. in cross diameters and 3 cm. in thickness. One surface was completely covered by smooth gastric mucosa except for three irregular ulcerated areas. Between the muscular coat and the mucosa was a large, irregular, somewhat lobulated, firm, elastic, encapsulated tumor mass consisting of fairly uniform, pinkish-gray, translucent tissue. The gross appearance was suggestive of neurofibroma or leiomyoma.

Microscopic examination of the section showed an encapsulated tumor mass between the muscular and mucosal coats of the stomach. It consisted principally of spindle-shaped connective tissue cells of variable size, forming large quantities of intercellular substance. In other areas the tumor was very loosely arranged and consisted of stellate cells of variable size, forming an intricate reticular type of tissue with many spaces which probably contained mucinous material. In still other areas the tumor cells varied

greatly, many being quite large and multinucleated. Mitotic figures were scarce. One section including the mucosa of the stomach showed an area of ulceration extending down to the tumor growth with complete loss of epithelium. In this area there was considerable acute inflammatory reaction. The final pathologic diagnosis was neurofibroma of the stomach.

In a review of the literature we have found a rather wide variation in the incidence of benign gastric tumors. Although most authors have found them to be uncommon, Rigler and Erickson[1] have reported a much higher incidence of these lesions. They have summarized their findings in two series of cases, the first consisting of 239 tumors of the stomach or duodenum in which 11 per cent were diagnosed as benign by roentgen examination. In the other series of cases they have reported 194 tumors of the stomach and duodenum found at autopsy in which 25 per cent were found to be benign. This, it would seem, is an unusually high incidence for benign tumors.

Our own experience, on the basis of autopsy, surgical, and roentgen findings, indicates a much lower incidence. We have seen only 17 benign gastric tumors in 250,000 admission records at the Cleveland Clinic. In this group 12 cases have been definitely proved benign by histologic examination at autopsy or surgical operation. Of these proven cases three have been neurofibromata and three leiomyoma. This finding is of interest since the leiomyomata have generally been accepted as, and probably are, the most common benign tumor of the stomach.

Shallow and Lemmon[2] have made a report of 13 cases of benign tumors of the stomach in a review of 300,000 case histories, covering admissions to Jefferson Hospital, Philadelphia, for the period 1909 to 1939. Eleven of these cases had a histologic diagnosis, only one of which, however, was neurofibroma. Minnes and Geschickter[3] in 1936 reviewed the literature covering 931 benign gastric tumors and reported 50 cases of their own from the Johns Hopkins Hospital. In both series the leiomyomata group was the largest and made up approximately one-third of the total number. In their own series they have reported only one neurofibroma, but this type of tumor was present in 10.9 per cent of the collected cases.

The symptoms produced by the benign tumors are quite indefinite and vary greatly. They may depend upon the size, location, and the presence or absence of associated ulceration. Many of these patients have ulcer-like distress which is one of the most common complaints. This distress may be relieved by ulcer management, and the true cause not discovered unless a thorough examination is made. Another common complaint is hemorrhage, which may or may not be associated with other symptoms, and which may vary from occult blood to hematemesis. The cause is apparent since most tumors, as they increase in size, show a thinning of the mucosa over the summit of the mass with

single or multiple ulcers. The occurrence of hemorrhage with benign gastric tumor should be kept in mind, as this may at times be the only symptom, and the patient may be in good health during the interview. If the tumor is at the pylorus, obstruction may be present and in a pedunculated type of lesion is often intermittent in character. The smaller tumors, not associated with ulceration and located in the body

FIGURE 1. Fluoro-roentgenogram of a gastric neurofibroma. This film was made with moderate degree of compression to show the smooth contour of the tumor and the three ulcer niches.

of the stomach, are usually asymptomatic and discovered only by the surgeon or pathologist.

The diagnosis of benign gastric tumor depends first upon the roentgen examination and second upon the gastroscopic examination.

In the larger tumors the entire surface may not be visible to the gastroscopist, hence, the former procedure may give more reliable information concerning the nature of the lesion. This is illustrated in Figure 1 in which three ulcer niches are demonstrated on the surface of a neuro-

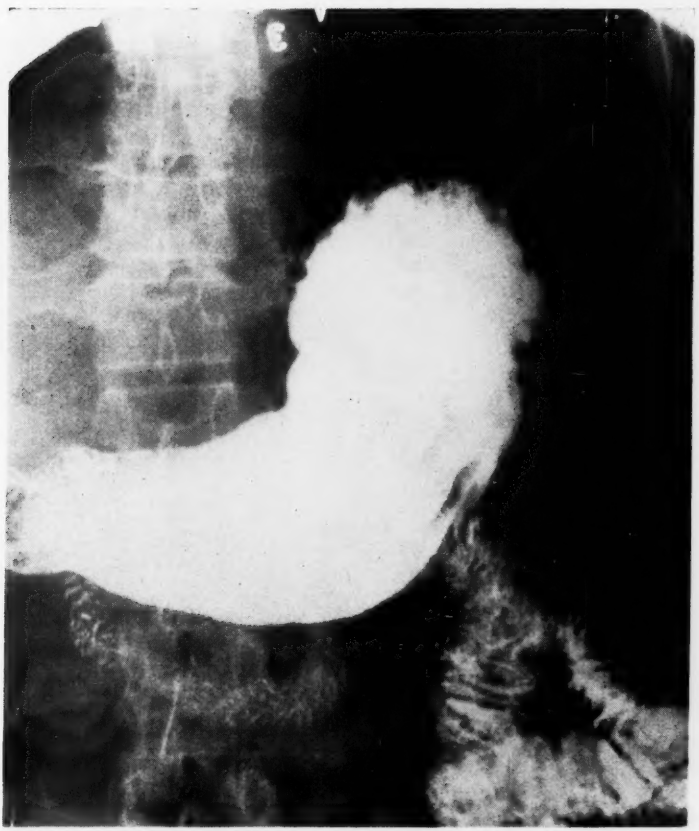

FIGURE 2. Posterior-anterior film of stomach containing a large amount of barium which obscures the tumor.

fibroma which were not visualized at the time of gastroscopic examination. By no preoperative method may the class of benign tumor be differentiated, nor may its status always be determined. Leiomyomata and neurofibromata may have the same gross appearance, and the true histology is often not determined until special stains have been used by the pathologist. The same holds true for malignant changes,

which may be present but not discovered before the pathologic examination.

The technic[4] employed for the examination is essentially that routinely used for the roentgen examination of the stomach. This consists of a preliminary examination with a small amount of barium. At this

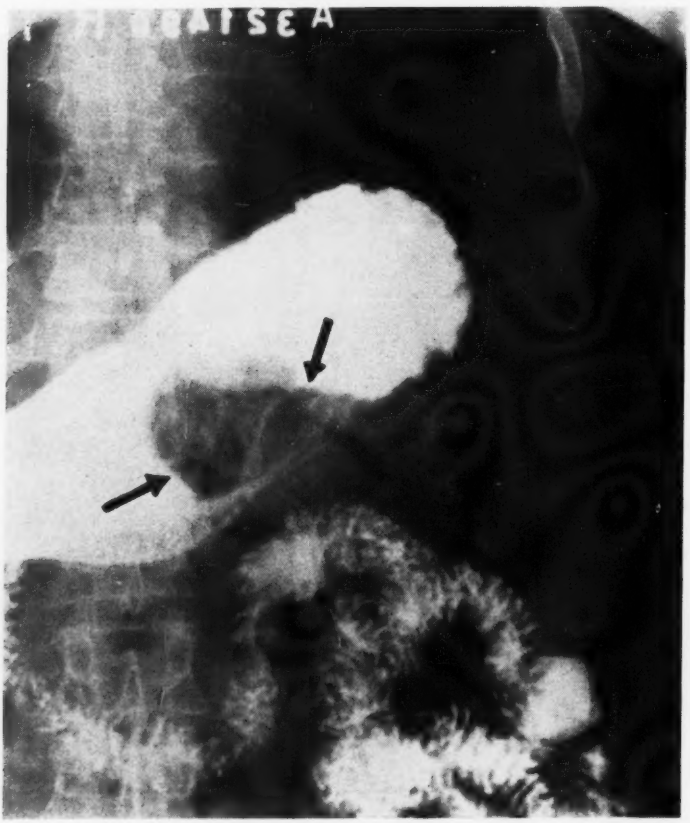

FIGURE 3. Anterior-posterior film of stomach in which the tumor is visualized in spite of the large amount of barium present. Note the smooth contour of the tumor.

time thorough palpation is used in the attempt to show the complete mucosal pattern of the entire stomach. We cannot overemphasize the importance of this phase since lesions may be obscured and completely overlooked by using a larger amount of the opaque meal. The illustration in Figure 2 shows how even a large tumor can be almost completely

obscured by a large amount of barium solution. This film is of the same stomach as that in Figure 3, and both were made at the original examination of the case under discussion. During this initial phase films may be made to record the characteristics of the mucosal pattern.

The second portion of the examination, which is continuous with the foregoing preliminary phase, makes use of a greater amount of

FIGURE 4. A smooth bordered filling defect in the distal end of the stomach with an ulcer niche on its surface. Histologic examination proved this to be a neurofibroma.

the barium solution. This should be limited in amount, however, and we prefer to use not more than a total of seven ounces. If a "spot film" device is available, films may be made at any time during the fluoroscopic examination, and any questionable finding should have the benefit

of this technic. After satisfactory fluoroscopy the standard radiographic films may be made of the filled stomach. It is desirable at that time to make use of the positions which allow the best visualization of the various portions of the stomach. Here, due consideration must be given to the shifting bulk of the barium and to the intragastric air bubble.

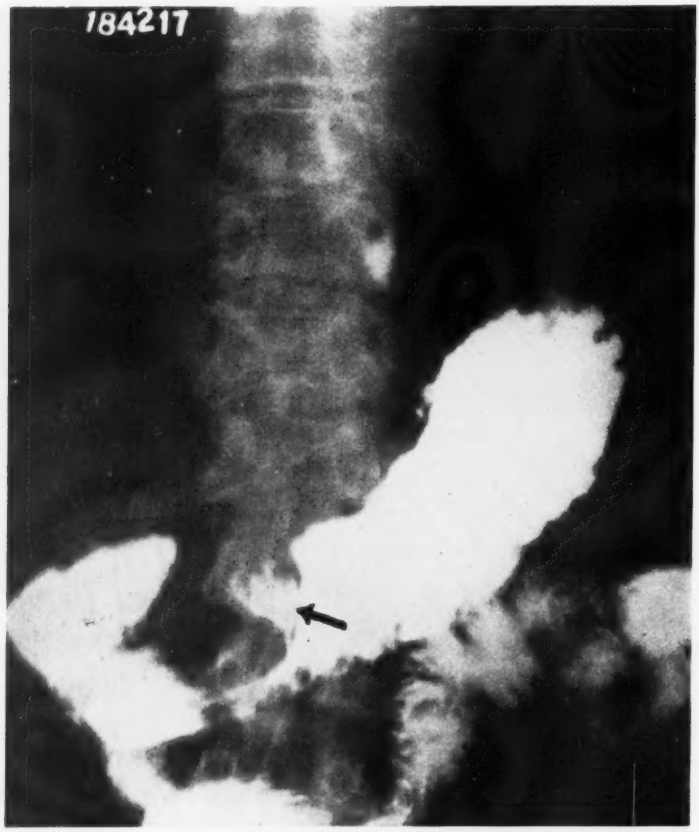

FIGURE 5. A posterior-anterior film showing a neurofibroma at the distal end of the stomach. The tumor presents a smooth contour with a rather large ulcer niche of the mucosa.

The utilization of the air bubble is a great aid at times as a lesion may be visualized through it, but be obscured by the opaque meal in other positions.

The roentgen appearance of these lesions is fairly characteristic and consists of smooth bordered, filling defects in the barium filled stomach. Ulcers on the surface of the mass are usually prominent if seen *en face*.

This effect is seen in Figures 4 and 5 in which a filling defect with evidence of ulceration is seen in the distal portion of the stomach. Fluororoentgenograms are frequently of considerable value and may be employed to demonstrate certain features of the lesion exactly as seen during the fluoroscopic examination. The illustration in Figure 1 is a fluororoentgenogram which was made chiefly to show the three ulcers as seen by the fluoroscopist, but which were obscured in the routine stomach films.

SUMMARY

Benign gastric tumors, relatively uncommon clinically, frequently escape diagnosis during life. This may be due to absence of symptoms, but they should be suspected if there is unexplained gastric hemorrhage.

A fairly characteristic roentgen appearance, which has been illustrated, may be present. It is, however, impossible to make a final diagnosis of benign gastric tumor by any means other than histologic examination.

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UNUSUAL TUMORS SIMULATING PROTRUSION OF THE INTERVERTEBRAL DISC

WM. A. NOSIK, M.D.

In any of the various branches of medicine and surgery it is of basic importance to diagnose a given condition as accurately as possible. Very often a given lesion will produce characteristic signs and symptoms as with the protruded intervertebral disc in the production of low back pain with sciatic radiation. By the use of suitable diagnostic procedures, not the least of which is a careful history and physical examination, an intelligent therapeutic attack may be planned. Even though all reasonable possibilities have been considered, a presumably "simple problem" may be loaded with surprise. It is just as important to stress the necessity for avoiding the error of omission in the diagnostic effort as an error of commission in the therapeusis.

In recent years the syndrome of protruded intervertebral disc as a source of low back pain with sciatic radiation has aroused considerable interest. Because the history is often so typical and the physical findings so conclusive, it is almost inevitable that there should be a tendency to relax diagnostic vigilance. As this syndrome is encountered more frequently and as the surgeon's experience enlarges, it is easier to overlook the limitations of the general and special physical examinations, i.e., orthopedic and neurologic. This, however, is no more true of the protruded intervertebral disc syndrome than of any other. Each individual patient presents a particular problem in the choice of a diagnostic routine. Whether or not lumbar puncture or x-ray study, with or without an intraspinal contrast medium, should be made is a point in the judgment of each individual case to be dictated by necessity rather than by a fixed routine.

The individuality of the problems presented by the syndrome of intervertebral disc protrusion can best be demonstrated by the presentation of the following cases.

Case 1. A 45 year old white laborer complained of low back pain with "sciatica of the left leg" of two years' duration. He recalled feeling a sharp snap in his back after lifting a hundred pound sack of potatoes. The leg pain began thereafter and was exaggerated by coughing and straining. He noted atrophy and a progressive weakness of the left leg. Alcohol injection of the left sciatic nerve had been done elsewhere, but had failed to give satisfactory relief from pain.

Examination disclosed atrophy of the left thigh and calf, possibly from the alcohol injection. The left knee jerk was absent, as were both Achilles jerks. Weakness of dorsal and plantar flexion of the left foot was present. There was a band-like area of hypesthesia involving the lower left calf and the toes and sole of the left foot. The Naffziger and Laségue tests were negative.

The laboratory findings upon examination of the urine, blood, and spinal fluid were normal.

The clinical diagnosis was neurofibroma involving the left fourth lumbar nerve, or a protruded intervertebral disc on the left side between the fourth and fifth lumbar vertebrae. To clarify the situation a thorotrast myelogram was recommended and done

(Fig. 1). A large neoplasm, intradural in location, was seen almost completely obstructing the spinal canal at the level of the second and third lumbar vertebrae. The preoperative diagnosis was intradural tumor originating from the fourth lumbar nerve.

A laminectomy was done under pentothal anesthesia. The laminae of the second and third lumbar vertebrae and a portion of the fourth lumbar vertebra were removed, and the presence of an intradural tumor mass was evident to palpation. The dura was incised for the length of the exposure, and upon retraction of the cauda equina a large,

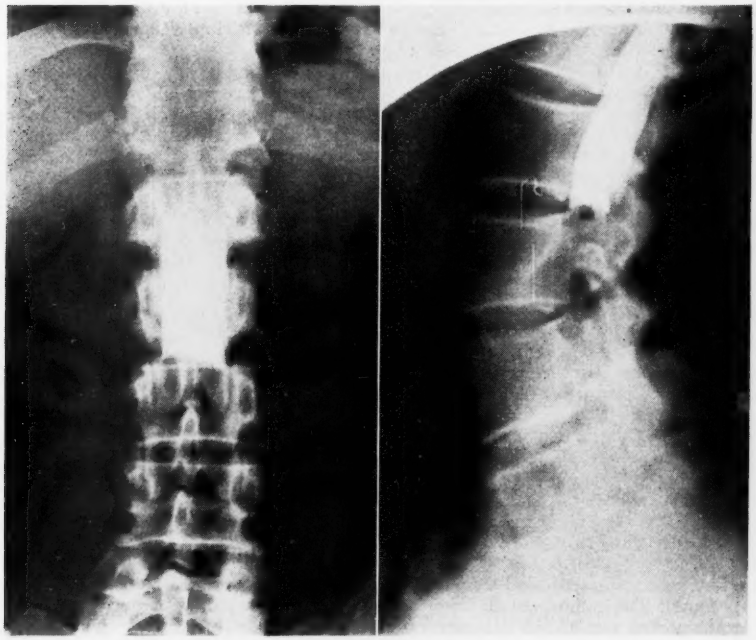

FIGURE 1. Direct frontal and lateral views of the thorotrast column. Position of intradural tumor is accurately determined, and in the lateral view its lower border can be faintly seen.

slate-blue, rubbery tumor mass filling the entire spinal canal was found. The tumor mass was approximately 5 cm. long and apparently well-encapsulated. After the nerve roots were retracted, the tumor was rolled to the right and was found to have entered the spinal canal via the course of the right third lumbar nerve. This nerve was so involved in the tumor mass that it was decided to sacrifice it, which was done between two silver clips. Although it could not be definitely established, this area was possibly the site of origin of the tumor mass. The tumor was incised, and the interior evacuated by suction. By grasping the empty capsule the operator was able to excise the circular dime-sized area of the dura together with the involved nerve in removing the intraspinal tumor mass. It was immediately evident that the largest part of the tumor extended through the intervertebral foramen on the right and into the right prevertebral space. More bone was rongeured away, and the tumor mass extended into this area for approximately 7 to 8 cm. By aspiration of the contents of the capsule and by grasping the capsule in the manner of emptying a sac, the operator was able to remove the tumor mass entirely to what appeared to be a small constriction at the depth of approximately 8 cm. It was evident, however, that more tumor lay in the extreme prevertebral area in a position inaccessible by this approach. The dura was then closed by a continuous run-

ning suture. The muscles were reapproximated, and the wound closed without drainage.

Gross description of this tumor revealed that the specimen consisted of multiple small portions of a velvety blackish-brown material, parts of which were encapsulated with a thin brown fibrous capsule. The gross appearance was that of a melanoma, which was confirmed by microscopic diagnosis.

The patient made an uneventful recovery and was discharged on the eighteenth hospital day. The only residual symptom was a left foot drop of moderate degree for which he was fitted with a spring lift. The patient was completely relieved of his pain and felt remarkably well. The last report, over a month later, indicated no evidence of recurrence, although this was almost a foregone conclusion. Repeated subsequent examinations revealed no evidence of a primary source.

Case 2. A 24 year old tool maker complained of pain in his right hip of eight months' duration. It had begun as low back pain approximately three or four weeks after a mild throat infection. The severity of the symptoms had gradually increased with the pain shifting from the back to the right hip also. Changes in position caused sharp shooting pain in the right hip with radiation to the posterior aspect of the thigh, calf, ankle, and heel. Walking would frequently produce such radiation of pain. He did not recall any immediate injury except for a back injury incurred ten years before in a fall from a bicycle, and did not believe that this was related to his symptoms.

The general physical examination revealed no abnormalities which might have contributed to the described condition. Examination showed a definite list to the right with restriction of motion on bending. The right thigh showed a half inch atrophy. There was a positive straight leg raising test on the right. The knee jerks and Achilles reflexes were equal and active. There were no motor disturbances of the leg.

Urinalysis, blood counts, blood chemistry, serological examinations, and spinal fluid examinations revealed no significant deviations from the normal. The clinical diagnosis was protrusion of an intervertebral disc. Thorotrast myelography was advised, and a circular defect in the thorotrast column noted. The defect was interpreted as a neurinoma of the fourth nerve. Upon close scrutiny of the films its attachment to the nerve could be seen. The preoperative diagnosis was neurofibroma of the right fourth lumbar nerve (Fig. 2).

Laminectomy was done under avertin anesthesia. The lamina of the fourth lumbar vertebra was removed as well as the ligamentum flavum. The dura appeared to be normal. A firm mass could be palpated through the dura at the level of the lower portion of the fourth lumbar vertebra on the right side. The dura was opened in the midline and retracted widely. An ovoid tumor about 1.5 cm. in its longest dimension was found. The tumor was definitely attached to one nerve, apparently to the right fourth lumbar nerve, and partially extended into the foramen, but did not have an extradural projection. The nerve was found to enter and leave the capsule distally. The nerve was divided between clips about 4 mm. above and below the tumor. The tumor was firm and elastic in consistency and had a definite capsule. No other lesions were found in the cauda equina at this level. A routine closure was made.

The gross description of the lesion revealed it to be a small, encapsulated, ovoid tumor attached to the nerve root. The tumor was firm and elastic. The external surface was smooth and gray in color. Cross section through the nerve and its attached tumor revealed that the tumor originated from the nerve sheath. The capsule of the tumor was light in color except for diffuse small areas of hemorrhage. The gross diagnosis was neurofibroma, as was also the microscopic diagnosis.

The patient had an uneventful postoperative course except for a moderate degree of urinary retention in the first 48 hours which responded well to drugs. Upon his discharge from the hospital 20 days later the patient was walking freely without loss of motor power and with only mild symptoms of hypesthesia upon the dorsum of each foot and the back of the left calf. He was completely relieved of his pain, and after progress study several months later the patient returned to work. The only residual finding was a small area of numbness in the lateral side of his right foot.

Case 3. A 41 year old police officer complained of pain in the back of two months' duration. He recalled that his symptoms had begun when he had been "kicked" by his motorcycle in starting it. He had been thrown into marked hyperextension and had noted a sharp, lower back pain. Several days later the pain had extended into his leg

and had radiated down the posterior aspect to the foot. He had been confined to bed for one week, and after an adequate rest period had resumed very limited activities at the station house. The pain, however, had persisted. Several adjustments had been made by a chiropractor, and the patient had improved enough to return to work. The pain had recurred and became almost constant. From that time he had been confined to bed until his hospital admission.

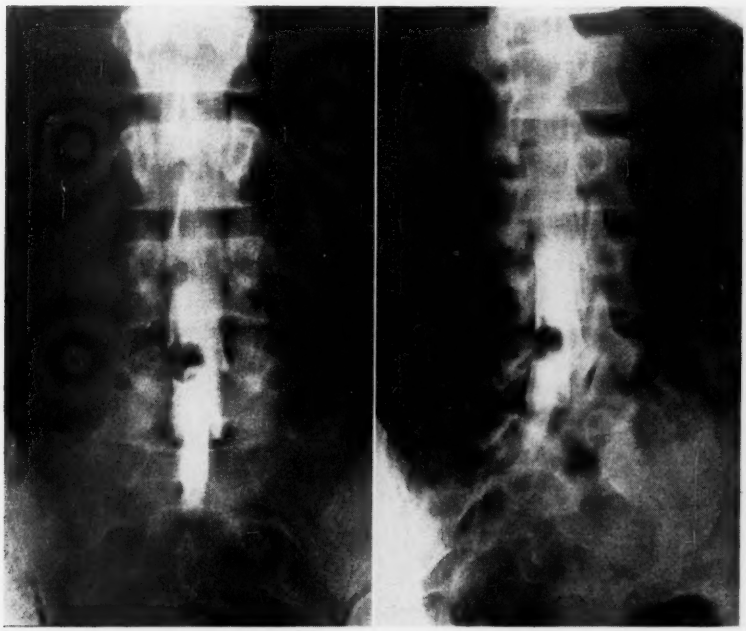

FIGURE 2. Thorotrast myelogram showing frontal and oblique views of thorotrast column. The nerve with its attached neurofibroma as well as area of attachment can be seen.

The pain was aggravated by coughing and sneezing and was located in the lower lumbar area. More or less constant in its presence, it was aggravated by the jolting of the patient's motorcycle. He had a loss of muscle power in his leg and some paresthesia, especially of the right great toe, which had improved considerably over a period of three weeks.

The general examination revealed no abnormalities which might have contributed to the general symptoms. Upon examination a deviation of the spine to the right was noted. The back was flattened, and there was marked restriction of motion of the back in all directions. Half inch atrophy of the left thigh and left calf was present. The knee jerks were present, but decreased. The ankle jerks were absent bilaterally. Lumbosacral x-rays revealed a narrowing of the disc between the fifth lumbar vertebra and the sacrum. No sensory changes were found; Naffziger's sign was negative; the Laségue sign was positive on the left.

Urinalysis, blood examinations, blood chemistry examinations, and serologic reactions were entirely normal in every respect. Spinal fluid examination revealed the presence of 3 cells and 120 mg. of protein. The clinical diagnosis at this time was protruded intervertebral disc between the fifth lumbar and the first sacral vertebrae, probably obstructing the canal.

To establish this diagnosis a thorotrast myelogram was recommended before laminectomy was performed. The myelogram showed an almost complete block at the level of the mid-portion of the fourth lumbar vertebra (Fig. 3). A large anterior filling defect was seen in this region. The mass extended downward to the superior margin of the first sacral vertebra. The preoperative diagnosis was extradural tumor opposite the fourth and fifth lumbar and the first sacral vertebrae.

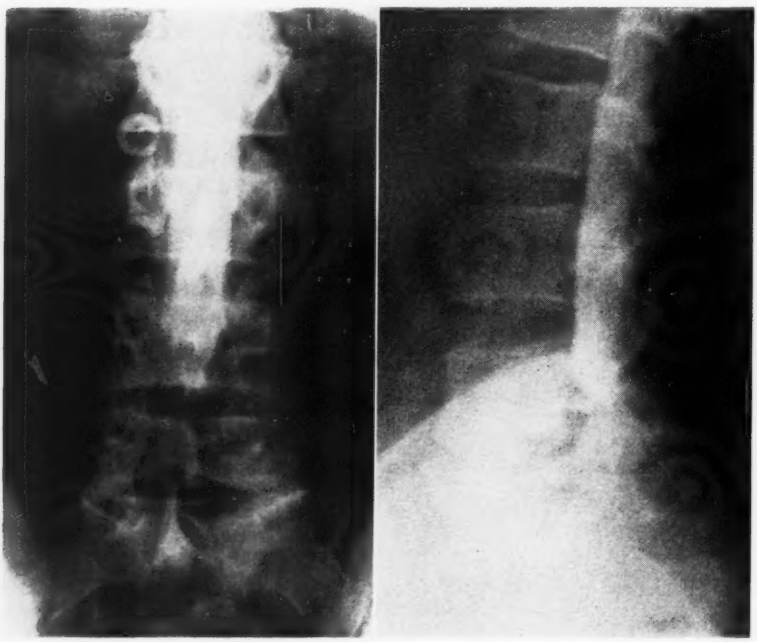

FIGURE 3. A direct frontal and lateral view of the thorotrast column showing the presence of an almost complete obstruction originating extradurally. A small amount of thorotrast is seen beyond the obstructed area.

Under pentothal anesthesia a laminectomy was done. The spines and laminae of the fourth and fifth lumbar, and a portion of the first sacral vertebrae were removed. Palpation of the dura revealed the presence of a firm smooth mass compressing the spinal canal extradurally and lying on the posterior surface of the vertebral bodies. Incision was made into the dura, and the nerves seemed to be compressed from the anteriorly placed mass. The dura was retracted medially, and the anterior epidural space explored. A large, gummy, grayish-tan tumor was seen lying anterior to the dura in this region, extending from the third lumbar to the second sacral and involving the anterior portion of the dural sac and the fourth and fifth lumbar and first sacral nerves. With retraction the tumor was separated from the dura and nerve sleeves by dissection to the midline. This mass was then sectioned from the body of the tumor, and the same process repeated on the opposite side for the length of the exposure. Upon removal of this tumor the freed nerve sleeves and their contained nerves seemed to be almost suspended in space. Shreds of tumor tissue undoubtedly remained attached to the periosteum, although all evident tumor was apparently removed. Hemostasis was effected, and the dura closed with a single continuous black silk suture. The anterior dural wall seemed to have been invaded by the tumor in the fourth lumbar region. The wound was closed in routine fashion without drainage.

Gross description of this tumor showed it to be a grayish-tan mass, rubbery in consistency, which roughly took the form of the lumbosacral canal with extensions that enveloped the nerve sheaths. It was approximately 2 cm. thick and 7 cm. long. Microscopic examination revealed it to be plasma cell myeloma.

The patient made an entirely uneventful recovery and was discharged from the hospital on the twentieth day. The patient has been carefully studied in follow-up examinations. Special blood counts, sternal puncture, and repeated x-rays have shown no evidence of metastases or further lesions. An occasional abnormal plasma cell has been reported in the sternal puncture. The blood has been found positive for the Bence-Jones protein, but repeated urinalysis has not revealed this finding. Recheck examination has revealed his condition to be excellent, with general improvement in the neurologic findings.

DISCUSSION

Summaries have been presented of the findings in three patients who had the classical syndrome of the protruded intervertebral disc. In two of these three cases the onset of the difficulty was incorrectly ascribed in all honesty to a specific back trauma. As is not infrequently the case, the trauma possibly served only to call attention to an already existing pathology.

In these patients, two of whom had an intradural and one an extradural tumor, the clinical findings were those of a protruded intervertebral disc. These tumors were especially interesting in themselves in that they were rather unusual in type and location. While the single neurofibroma, developing from the epineurium of a nerve, is frequently found in the spinal canal, the only concern here was that an exact preoperative diagnosis could be made with the methods at hand.

It is of considerable value to the surgeon in planning the operation to know the exact location and possible nature of the lesion he expects to encounter. This was evident in the other cases, i.e., the intradural melanoma and the extradural myeloma, where the exact location and disposition of the tumor was known and the surgical attack considered in the light of the pathology most frequently encountered in this diagnostic pattern. Whether or not the melanoma was primarily of meningeal origin can be determined only at autopsy, since no detectable evidence of a primary source existed. The presence of an isolated extradural myeloma without the presence of multiple lesions is an infrequently encountered circumstance. In this case, as in the others, there was no evidence of another lesion.

The presentation of these cases illustrates the fact that even though a syndrome as well defined as that of the protruded intervertebral disc may be present, all diagnostic measures should be utilized in its final clarification. It is noteworthy that other common or uncommon conditions, surgical or nonsurgical, may simulate this clinical picture. Infallible accuracy in diagnosis is not always possible, and valuable information may be overlooked to the patient's detriment if the available methods of examination are not fully utilized in a given case.

SPECIAL LENSES FOR THE POOR-SIGHTED

ROSCOE J. KENNEDY, M. D.

Contact Lenses. Many persons on the borderline of economic blindness can be helped by the use of special lenses. Keratoconus is one condition which has long been recognized, but for which treatment has not offered a good prognosis for improvement in sight. In recent years, however, contact lenses have been developed to help this condition, and in the past year even greater benefits have been obtained from the use of plastic contact lenses (Fig. 1).

FIGURE 1. Plastic contact lens.

Keratoconus as defined by Duke-Elder[1] is "a condition which involves stretching of the cornea in an axial part becoming manifest usually in the youth or adolescent and resulting in a visual impairment owing to the development of a high degree of astigmatism. It is a non-inflammatory ectasia or in a sense an anterior myopia."

The etiology of keratoconus is unknown. Most of our cases at the Clinic, however, have been associated with a definite allergy. In other cases a coexisting endocrine imbalance has been noted. One patient, a woman past 50, had normal vision ten years ago. A recent examination following a thyroidectomy and subsequent hypothyroidism showed a definite keratoconus. In another case the condition occurred following pregnancy. In one case the condition occurred three months after the use of sulfathiazole.

Keratoconus is usually bilateral. Thirty-three of 39 cases seen at the Clinic, or about 90 per cent, were bilateral, and four cases were unilateral. To date, I have seen the condition only once in successive generations. This occurred in a father and daughter both of whom had a unilateral keratoconus with the other eye normal.

Contact lenses may also be used in other conditions such as keratitis, neuroparalytica, etc., and in place of ordinary glasses in hyperopia or myopia.

At the present time, we are using the Obrig plastic lenses which have a distinct advantage over the old glass lenses in that they are un-

breakable, weigh about one-third less, and can be much more accurately fitted. Five patients with keratoconus have been fitted with contact lenses, all of whom had a bilateral condition except one patient, a young man of 19. Twelve patients have been fitted for compound myopic astigmatism with errors varying from a minus 1.75 to minus 28.00 diopters, and three patients have been fitted with contact lenses for aphakia. In all about 30 plastic lenses are being used by patients at this Clinic, and to date they have had no difficulty with them. In only two cases did we believe that contact lenses could not be accurately fitted, and these patients were advised to have corneal transplants.

The technic for fitting contact lenses is not difficult. The only requirements are proper equipment and the cooperation of the patient. Before fitting the lenses the patient should have a routine refraction under mydriatic in order to obtain the maximum vision with correction. If there is over 0.75 diopter of astigmatism, it is generally accepted that contact lenses are not indicated. The trial contact lens is then placed in the eye, and refraction is done with the lens in place. At the same time the vertex distance from the contact lens to the trial lens should be measured. After the eye has been completely anesthetized, an impression of each eyeball is taken by means of a casting shell and Negocoll. The casting with Negocoll is a very accurate reproduction of the eyeball which the inner surface of the contact lens will fit. A semi-finished lens is then made which allows for any changes which may be necessary to achieve the vision obtained by the original examination. The lens should also be checked at this time for both scleral and corneal fit. Before being inserted into the eye, the lens is filled with buffer solution, of which Gifford's solution is the most commonly used with a fairly high pH (between 8 and 9).

Four factors are involved in the fitting of contact lenses. (1) The optical fitting consists of finding the curvature of the trial contact lens used in refraction, the power of the lens, and the vertex distance. (2) The physical fitting consists of taking the cast. (3) The chemical fitting involves taking the pH of the tears in order to determine the proper buffer solution which will be tolerated by the eye. (4) The physiologic fitting includes a consideration of the patient as well as instruction in inserting and removing the lens. Therefore, the requisites for a good fitting contact lens are: (1) It must be the proper size covering a large area without any peripheral pressure. (2) It must not be in contact with the cornea or limbus. (3) It must not ride nor rub over the cornea or the limbus when the eye is moved. (4) Air bubbles must not form under the glass. (5) The glass must not cause the formation of corneal abrasion. (6) The optical correction must give the desired vision. Only when these requisites are filled can contact lenses be considered satisfactory. It must be remembered, however, that although we can promise the patient a proper fit

with vision as good as or better than the present correction, we cannot guarantee how long they will be able to wear the contact lenses. Usually patients wear the lenses one or two hours daily until they develop a tolerance to them. The principal disadvantages of contact lenses are that they are: (1) difficult to manipulate, (2) uncomfortable—for example, they may be too tight, although this has been greatly eliminated by the use of plastic lenses,—and (3) relatively high-priced.

Aniseikonia. Another condition which has received considerable publicity is aniseikonia, which means any difference in the relative size and shape of the ocular image. Boeder[2] has defined aniseikonia as "that condition of the binocular visual apparatus in which the ocular images are unequal in either size or shape, or both." The term "ocular image" is applied to the final impression which reaches consciousness in the higher brain centers, and therefore, its effective size depends not only upon the dioptric image formed on the retina of the eye, but also upon the distribution of the receptive retinal elements and upon the physiologic and cortical processes involved. It follows that aniseikonia may be caused by an anomaly in any one or combination of the elements involved in the formation of the ocular image. This important observation excludes the possibility of calculating the amount of aniseikonia from a given prescription.

That aniseikonia exists in certain troublesome conditions, such as monocular aphakia, has long been recognized. In antimetropia and in anisometropia most authorities agree that one difficulty that the patient experiences results in differences in the size of the image. Patients may satisfy the recognized requirements for binocular vision and yet have aniseikonia. Formerly many of these cases were called ocular neuroses. The difference in the size and shape of the ocular image may be classified as follows: (1) overall difference, one image large in one meridian only; (2) meridional difference, one image large in one meridian only; (3) compound difference, difference may be various combinations of overall and meridional differences.

The symptoms of aniseikonia are the same as those of common refractive errors, that is, photophobia, train and car sickness, fatigue, difficulty in reading, dizziness, gastrointestinal upsets, headaches, etc. If correction of refractive errors fails to bring relief, the test for aniseikonia is indicated.

The treatment consists of lenses which are designed to correct not only the focus of the rays entering the eyes, but also the magnification of the images formed on the retina.

Telescopic Lenses. A large group of patients whose symptoms are not necessarily due to a refractive error cannot be given satisfactory vision

with any single opthalmic lens. Telescopic lenses are of value in high myopia with marked retinal and vitreous damage, in partial cataracts, corneal opacities, chorioretinal disease, glaucoma, and uveal diseases with fixed and partically occluded pupil. However, they are not of much use in retinitis pigmentosa, optic atrophy, and inoperable cataract. The disadvantages of telescopic lenses are that they give the patient tubular vision and that they are cumbersome to use.

SUMMARY

All these special lenses offer some hope for the patient who is hard to fit or cannot be helped with ordinary lenses. They should be added to the armamentarium of all oculists who should be acquainted with their use and the technic of fitting them. By the use of special lenses many patients not only have been brought out of a world of blindness but also have been made useful again and have been able to carry on their usual occupation.

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